

**MANAGEMENT OF EDUCATIONAL INNOVATION:
THE CASE OF
COMPUTER-AIDED ADMINISTRATION**

by

Alexander Chi-wah Fung

A thesis submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy

in
the University of London Institute of Education

1992



ABSTRACT

This thesis is concerned with the process of managing an educational innovation - computer-aided administration (CAA) for schools. From literature reviews in the areas of management of change and computer assisted school administration, together with findings from an observer case study in the United Kingdom, a model was generated for the CAA innovation process as a contribution to theory. The model was then put into practice as the framework for the CAA innovation process in a secondary school in Hong Kong. The innovation was successfully assimilated by the school in a period of about three years with the researcher acting as the change facilitator, and the model of the innovation process was subsequently refined. This refined "SIX-A" model it is hoped will be a contribution to practical change management. Before making conclusions, findings about the process of innovation as well as findings specific to CAA from the case school are compared and contrasted to data collected from three other schools' CAA innovations in Hong Kong.

Keywords: *educational innovations, administrative computing, computer utilization, management of change*

ACKNOWLEDGMENTS

In the epilogue to the thesis, I use the analogy of an exploratory adventure for managing an educational innovation. It seems equally appropriate to use the same analogy to describe the research for a PhD. I was never alone throughout the whole journey and was greatly privileged to have my supervisor Dr. Pamela Young guiding and advising me all along. Her critical comments were inspiring and made me stretch my mind. The support and encouragement that she gave me were most needed to complete the thesis.

I am also indebted to Dr. John Welton for his supervision of my study during the period 1985 to 1986 when he was with DEAPSIE of the London University Institute of Education. He helped me much to lay a firm foundation for the whole thesis. I deeply appreciate his support not just for my research work but for making my stay in London both a happy and memorable one.

During my research I was fortunate to meet many dedicated professionals, school principals, teachers, and have made many friends. I am most grateful to them for their assistance and contribution to the research. Although I cannot mention all names, I must specially thank Peter Watts for his openness and kind acceptance for my participatory ILEA case study. I must also thank my good friends Dr. David Lancaster and Adrie Visscher for sharing their valuable reference materials as well as expert opinions on CAA.

Typing, editing, and printing of a thesis used to be a tough job. I did them all by myself and found it to some extent even enjoyable - with my microcomputer. I am grateful to the many anonymous people who have contributed to the development of the technology.

I was well looked after by my beloved wife Mimi and daughter Kim over the past six years when I was preoccupied by the research and nothing can reciprocate their love. To them I dedicate this piece of work.

TABLE OF CONTENTS

		PAGE
	ABSTRACT	i
	ACKNOWLEDGMENTS	ii
	TABLE OF CONTENTS	iii
	LIST OF FIGURES	vi
	GLOSSARY	vii
CHAPTER 1.	PURPOSE & ORGANISATION OF THE THESIS	1
	1.0 INTRODUCTION	
	1.1 PURPOSE OF THE STUDY	1
	1.2 CAA & INFORMATION MANAGEMENT	5
	1.3 ORGANISATION OF THE THESIS	6
CHAPTER 2.	REVIEW OF LITERATURE I - SYSTEMS THEORY	8
	2.0 INTRODUCTION	
	2.1 SYSTEMS AND ORGANISATIONS	9
	2.2 SOME PROPERTIES OF SYSTEMS	11
	2.3 CLASSIFICATION OF SYSTEMS	12
	2.4 DELIMITATIONS ON SYSTEMS APPROACH	15
CHAPTER 3.	REVIEW OF LITERATURE II - EDUCATIONAL CHANGE & INNOVATION	18
	3.0 INTRODUCTION	
	3.1 EDUCATIONAL CHANGE AND INNOVATION	19
	3.2 ORIGIN/SOURCE OF EDUCATIONAL CHANGE	22
	3.3 INHERENT NATURE OF CHANGE	24
	3.4 WHY INNOVATIONS FAIL	27
	3.5 A TYPOLOGY OF INNOVATION FACTORS	29
	3.6 MODELS OF CHANGE	30
	3.6.1 GENERAL MODELS	
	3.6.2 PROCESS-ORIENTED MODELS	

3.7	STRATEGIES OF IMPLEMENTATION	PAGE 33
3.8	TYPES OF EDUCATIONAL INNOVATION	36
3.9	CAA AS AN EDUCATIONAL INNOVATION	38
3.10	THEORIES OF CHANGE, OR OF CHANGING?	39
3.11	CURRENT PERSPECTIVES ON CHANGE	42
3.11.1	CHANGE AND EXCELLENCE	
3.11.2	CHANGE IS A LEARNING PROCESS	
3.11.3	CHANGE AND PEOPLE	
3.11.4	CHANGE AND CULTURE	
3.11.5	CHANGE AND LEADERSHIP	
3.12	WHOLE SCHOOL APPROACH IN EDUCATIONAL CHANGE	56
CHAPTER 4.	COMPUTERS IN EDUCATIONAL ADMINISTRATION - TECHNICAL KNOWLEDGE	62
4.0	INTRODUCTION	
4.1	THE INFORMATION AGE	63
4.2	BENEFITS OF COMPUTERISATION	64
4.3	COMPUTERS IN SCHOOL ADMINISTRATION - A SHORT HISTORY	71
4.3.1	THE U.S.A. SCENARIO	
4.3.2	THE BRITISH SCENARIO	
4.3.3	THE HONG KONG SCENARIO	
4.4	CAA APPLICATIONS AND APPROACHES	86
4.4.1	THE TASK-ORIENTED APPROACH	
4.4.2	THE FUNCTIONAL APPROACH	
4.4.3	THE INTEGRATED APPROACH	
4.5	THE FUTURE SCENARIO: A SYSTEMS PERSPECTIVE FOR CAA IN HONG KONG	91
4.5.1	LESSONS FROM OTHER COUNTRIES	
CHAPTER 5.	RESEARCH DESIGN & METHOD	95
5.0	INTRODUCTION	
5.1	TWO PARADIGMS IN EDUCATIONAL RESEARCH	96
5.1.1	RATIONALISTIC VERSUS NATURALISTIC	
5.1.2	NATURALISTIC INQUIRY INTO REALITIES	
5.1.3	SYSTEMS APPROACH & ACTION APPROACH	
5.2	CASE STUDY IN EDUCATION	102

5.3	<i>STAGES OF THE RESEARCH</i>	PAGE 103
5.3.1	<i>INFORMATION GATHERING STAGE</i>	
5.3.2	<i>CASE STUDY I</i>	
5.3.3	<i>CASE STUDY II</i>	
5.4	<i>VALIDITY & CRITICAL SUBJECTIVITY</i>	111
CHAPTER 6.	<i>A REGIONAL CAA INNOVATION CASE IN LONDON: ESTABLISHING A TENTATIVE MODEL</i>	113
6.0	<i>INTRODUCTION</i>	
6.1	<i>THE ILEA CAA INNOVATION</i>	114
6.1.1	<i>CONTEXT FOR THE INNOVATION</i>	
6.1.2	<i>CHARACTERISTICS OF ILEA</i>	
6.1.3	<i>CONTEXT FOR CAA IN ILEA SCHOOLS</i>	
6.2	<i>THE INNOVATION CHANGE PROCESS</i>	119
6.3	<i>CAA POLICY DEVELOPMENT IN ILEA</i>	132
6.4	<i>CONCLUSIONS FROM ILEA'S CAA CASE</i>	140
6.5	<i>ESTABLISHING A TENTATIVE MODEL FOR INNOVATION</i>	145
6.5.1	<i>INNOVATION AS A WHOLE</i>	
6.5.2	<i>A FOUR-SYSTEM FRAMEWORK OF INNOVATION</i>	
6.5.3	<i>TARGET OF CHANGE</i>	
6.5.4	<i>ILLUMINATIONS FROM THE ILEA CASE</i>	
6.6	<i>A TENTATIVE MODEL FOR CAA INNOVATION</i>	154
6.6.1	<i>THE INITIATION PHASE</i>	
6.6.2	<i>THE IMPLEMENTATION PHASE</i>	
6.6.3	<i>INSTITUTIONALISATION</i>	
6.7	<i>RESEARCH QUESTIONS FORMULATED FOR CAA IN HONG KONG</i>	161
CHAPTER 7.	<i>A SCHOOL CAA INNOVATION CASE IN HONG KONG</i>	162
7.0	<i>INTRODUCTION</i>	
7.1	<i>CONTEXT FOR EDUCATIONAL RESEARCH IN HONG KONG</i>	162
7.1.1	<i>CONTEXT & BACKGROUND TO THE STUDY</i>	
7.2	<i>THE USER SYSTEMS - CHARACTERISTICS OF THE SCHOOLS</i>	165
7.3	<i>FEATURES OF THE INNOVATION SYSTEM - THE TECHNICAL ASPECT</i>	169
7.4	<i>THE CAA INNOVATION IN THE CASE SCHOOL SMC</i>	171
7.5	<i>EXTENT OF CAA APPLICATION IN THE SCHOOLS</i>	181

7.6	THE INNOVATION PROCESS	PAGE 184
7.6.1	THE INITIATION PHASE	
7.6.2	THE IMPLEMENTATION PHASE	
7.6.3	THE 'SIX-A' MODEL OF AN INNOVATION	
7.7	MANAGEMENT CONCERNS IN CAA	204
7.7.1	TASKS & OBJECTIVES OF CAA	
7.7.2	RESOURCE & TECHNOLOGY FOR CAA	
7.7.3	STRUCTURAL CHANGES & CAA	
7.7.4	PEOPLE & CAA	
CHAPTER 8.	CONCLUSIONS AND DISCUSSIONS	219
8.1	IMPLICATIONS FOR CAA IN HONG KONG	219
8.1.1	FORESEEABLE PROBLEMS	
8.1.2	RECOMMENDATIONS	
8.2	IMPLICATIONS FOR EDUCATIONAL INNOVATIONS & RESEARCH	227
8.3	EPILOGUE	230
ANNEX A	FRAMEWORK FOR CASE STUDY IN ILEA CAA	
ANNEX B	LISTS OF CAA APPLICATIONS	
ANNEX C	INTERVIEW GUIDE FOR DATA COLLECTION IN HONG KONG SCHOOLS	
ANNEX D	FUNCTIONS AND FEATURES OF MODULES IN HKSAS	

BIBLIOGRAPHY

LIST OF FIGURES

- Figure 3.1** **Change as a Transition**
- Figure 6.1** **Four Subsystems of an Organization**
- Figure 6.2** **Target of Change & Organizational Subsystems**
- Figure 6.3** **Tentative Model of an Innovation Process**
- Figure 6.4** **Merging of Innovation Goals**
- Figure 7.1** **The 'SIX-A' Innovation Model**

GLOSSARY

AEDS	Association of Educational Data Systems, U.S.A.
BCSSC	British Computer Society Schools Committee
CAA	Computer Aided Administration
CASA	Computer Aided School Administration
CET	Council for Educational Technology, U.K.
ED	Education Department, H.K.
EMB	Education & Manpower Branch
EMIE	Education Management Information Exchange, U.K.
FEMIS	Further Education Management Information System, U.K.
FEROS	Further Education Record of Students
JSEA	Junior Secondary Educational Assessment, H.K.
HKSAS	Hong Kong School Administration System
HMI	Her Majesty's Inspectorate, U.K.
ILECC	Inner London Education Computing Centre, U.K.
JUPAS	Joint University & Polytechnic Admission Scheme
LAMSAC	Local Authority Management Services & Computer Committee, U.K.
LMS	Local Management of Schools, U.K.
MEP	Microelectronics Education Programme, U.K.
NYSSCSS	New York State School Computer Services System
RDMS	Relational Database Management System

SCAMP	School Computerised Administration & Management Project, Scotland
SCHOLIS	School Information System, The Netherlands
SIMS	School Information Management System, U.K.
SMI	School Management Initiative, H.K.
SSPA	Secondary School Place Allocation, H.K.
SSRC	Social Science Research Council, U.K.

CHAPTER 1

PURPOSE & ORGANISATION OF THE THESIS

1.0 INTRODUCTION

The technological information explosion that took place during the past two decades has directly influenced almost every aspect in our society universally. Every organisation, together with the people in it, has experienced the impact to a greater or lesser extent. In the field of education, the question of how schools can enhance their management information systems and administrative work using computers has become a more recognised issue in the late 1980's. This particular issue has been clearly identified both in the United Kingdom according to the policy of Local Management of Schools (LMS, 1988), and in Hong Kong following the School Management Initiative (SMI, 1991).

1.1 PURPOSE OF THE STUDY

This thesis addresses the administrative use of microcomputers in schools and the process of successfully managing this innovation. For simplicity, the acronym 'CAA' which stands for 'Computer Aided Administration' is used. The use of this term is certainly not universal and Visscher et al. (1991) use 'CASA' (Computer Assisted School Administration), for instance, in the special issue of the *Journal of Research on Computing in Education* (September, 1991) for this topic. Other acronyms commonly used in the U.K. have their origins either from the software system developed (like 'SIMS' which stands for the School Information Management System) or from the project undertaken (like 'SCAMP' for the School Computerised Administration & Management Project in Scotland).

The acronym CAA originated from the Inner London Education Authority (Watts, 1985), and there are several reasons to use it in this thesis. Firstly CAA has a similarity to other common acronyms that stands for computer-aided activities; like CAL (Computer Aided Learning), CAI (Computer Aided Instruction), and CAD (Computer Aided Design). Furthermore, CAA is a discipline which should also cover many aspects in management and does not denote just a software developed or a project. In the writer's view, the software and hardware for administrative use is only the 'innovation sub-system' and does not represent the whole subject (see Section 6.5.2 for more details). Moreover, CAA has a broader perspective than CASA without limiting the administrative use of computers to the school level alone. As will be discussed in the concluding Chapter 8, the efficient and effective use of computers in administration and management of schools in Hong Kong unavoidably involves the central level education office. A holistic vision of CAA thus includes both schools and the central education office in its user sub-system.

The purpose of this study was to develop a model for managing the CAA innovation process in Hong Kong schools. This intention was derived partly from the personal background of the writer as a secondary school principal with experience in using computers to aid administration and he was almost certain that schools would have to adopt computers eventually in their administrative procedures. The problem for research was to explore how this change could be managed effectively. Why the writer was interested was that from observations in informal professional circumstances, some Principals in Hong Kong were likely to underestimate the difficulties and complexities of the implementation process. Findings from the study showed that this was in fact the case (see Section 7.6). When the writer studied the ILEA CAA innovation as an observer in 1986 during the first part of the research, there were also problems noted in the education authority getting to the policy stage prior to implementation. These reasons together prompted the writer to decide in the later part of the research to develop a model for change management (see Section 6.7) to enable practitioners to have a clear understanding of CAA in practice and possibly to apply the model to other innovations not dealt with in this thesis.

The need for better understanding and management of educational change is of particular relevance to Hong Kong schools in the 1990's now that the Government has taken the lead to start the 'School Management Initiative' (SMI, 1991). When this research work began in 1985, CAA was new phenomenon in schools in Hong Kong and the U.K. Overtaken by events during the past six years, CAA is now a commonplace phenomenon in the U.K. with the arrival of LMS (1988) and becoming so in Hong Kong with SMI (1991). (See Section 4.5).

In Hong Kong, since the introduction of compulsory education in 1979 for all youngsters up to the age of fifteen, it is no exaggeration to say that secondary schooling has been one of continual turbulence (Fung, 1989). Issues have been arising like waves one after another. Continually and incessantly over the past ten years, schools have had to deal with increasing demands and changes initiated externally by the Hong Kong Education Department as well as by higher education institutions. There are plenty of such examples: the floating-class system, the pupil record card system, the text-book assistance scheme, attainment tests, remedial teaching, school social work, expansion of extra-curricular activities and guidance work, revision and introduction of new curricula in sixth form, and JUPAS (Joint University & Polytechnic Admission Scheme). It is remarkable to note that Hong Kong schools can absorb so much without showing apparently signs of demand overload.

In the 1990's there are more challenges awaiting local educators: the issue of medium of instruction; the sixth form education reform; the vast expansion in tertiary education; the shortage of teachers; all of which are related in some sense to the unique and critical political question of 1997 when Hong Kong will be returned to China. All of these signify the need for schools to become more adaptive and skilful in problem-solving, managing change, and maintaining the status quo.

To be successful in their mission, schools will have to be more efficient and effective in the management of information, and computerisation is a requirement with high priority. This is one reason why schools should start the CAA innovation

as soon as they can. Another reason to encourage the CAA innovation in Hong Kong schools is that it can provide a good opportunity to learn about managing school innovations.

The majority of Hong Kong schools, in the writer's opinion and speaking from the experience of twelve years as a principal, are not innovative. The culture in most Hong Kong schools can be generally described as conforming. Rules and regulations from the Education Department, in administrative as well as curriculum matters, leave little flexibility for schools to be creative. Linkages or joint ventures between schools and higher education institutions for research are rare. School-based researches, school-based curriculum-development, and school-based staff-development are only known by name in many schools today. Very often schools are simply reluctant to supply data for educational studies, and teachers seldom welcome researchers into their classrooms (see Section 7.1). Lam (1991:75) shares a similar view. Lack of an open, learning attitude on the part of most teachers is one common obstacle to improving the quality of education. Lack of resource and time, on the part of teachers and principals in general, is undoubtedly also a major problem. More significantly perhaps is the lack of recognition by central authority that schools need to be more innovative for effectiveness (see Section 3.11.1).

In the writer's view, CAA can be taken as a stepping-stone for local schools to become more innovative. Comparatively speaking, CAA is a relatively easier school innovation to manage successfully than other school innovations, say in curriculum or organisational development (see Section 3.12). There are two reasons for this opinion: 1) CAA is task-oriented, systematic, and structured; and 2) CAA is less threatening to teachers because there is no direct conflict with other issues like curriculum or classroom procedures (unless the CAA system is designed to control rather than support staff, see Sections 7.7.1 & 7.7.4). Furthermore, from the experience gained in implementing the CAA innovation, schools can learn and understand more about key factors for innovation success. Such factors include, for example, knowledge about the process of an innovation; the people factor; the cultural or political factor; and the leadership factor (see Section 3.11 for details). In

addition, the writer thinks that the CAA innovation can contribute to initiate a learning attitude among school staffs which is an important criterion of innovation success as Fullan (1982, 1991) has pointed out. This has been confirmed as a finding in the study (Section 7.7.1). This has contribution to setting a climate for innovation in the school where people are allowed to experiment and fail without disgrace, and to go on to other activities or changes with confidence but increased experience. Schools should then be better prepared to attempt more educational innovations - in addition to the tangible time-savings (see Section 7.7.1) for their staff made as a result of CAA over time.

1.2 CAA & INFORMATION MANAGEMENT

The spiralling effect of the dramatic increase in the amount of information being stored on computers is, in a sense, self-fulfilling in the writer's opinion. Hirschheim (1985:21) has expressed a similar view about the spiralling office equipment market. As the need for more information grows, the information technology industry has expanded to meet the demand. As the industry grows, it has in turn created more capacity for information to be stored in and retrieved from computers. Thus advances in computer technology -- expansion of capability on the one hand and miniaturisation on the other -- bear a close relationship to the explosion of information.

In the business sector, management information systems (MIS) on computers are a necessity for competition and survival in the 1990's. In contrast, schools in Hong Kong are lagging behind in the development of MIS. Although social and economic developments of information technology had made it possible for the introduction of computers into the school curriculum in the past decade, CAA in Hong Kong schools is only at the experimental stage (see Section 4.3.3).

Justification for support and funding computers in the school curriculum, in the U.K. as well as in Hong Kong, was not difficult compared to the support for CAA. The aim put forward for the Microelectronics Education Programme (MEP,

1980) in Britain that cost eighteen million sterling pounds at the time suffices to speak for itself: "to help schools prepare children for life in a society in which devices and systems based on microelectronics were commonplace and pervasive" (Fothergill, 1981 in SSRC, 1983: 10). No specific provision was made for CAA then in the U.K., nor in Hong Kong when the subject of Computer Studies was introduced into secondary schools in 1982. However, once schools were provided with computers for teaching purposes, the possibility of using the machines in administrative areas was soon recognised. The opportunity to self-develop software for CAA was taken up in some schools both in the U.K. and in Hong Kong.

1.3 ORGANISATION OF THE THESIS

This chapter sets out the purpose of the thesis. A review of the literature follows in Chapters 2 to 4. Three different fields of theoretical relevance are examined including the literature on systems theory; writings and research on educational change and innovation; and literature on the administrative use of computers in education, especially microcomputers in secondary schools. Reasons for incorporating each of these areas of literature are given in the introduction of the respective chapters.

The exploration of the literature in Chapters 2 to 4 contributed significantly to the planning of the research as well as to the formulation of a theoretical framework with which to examine CAA in Hong Kong schools. This is why these chapters are presented before the research design.

In Chapter 5, the research design and method for the study are discussed together with limitations. A qualitative case-study approach was the basic method adopted, and two cases of CAA innovation were studied. The first case was about the Inner London Education Authority's (ILEA) innovation in the U.K. studied with an observer role when the researcher spent a year in London between 1985 and 1986, and the second case concerned a school's innovation in Hong Kong studied between

1987 and 1990 with a 'semi-participant-consultancy' approach (a shorthand used in the thesis to represent different roles of the researcher, see Sections 5.3.4 and 7.4 for the meaning of this term). Negotiations for entry to research and ethical considerations are also discussed in this chapter.

Chapter 6 describes the first case study of the ILEA CAA innovation. A tentative model for the innovation process was proposed as a result of this part of the study in U.K. Illuminations from the case of ILEA's attempt on CAA in the period between 1985 to 1986, in conjunction with major contributions found in the literature on educational change, form the basis of the tentative model established for practising the CAA innovation in schools. From the experience gained in observing the ILEA case, research questions were formulated for the CAA innovation in Hong Kong Schools (Section 6.7). The tentative model developed to manage the CAA innovation process was then put to work in one school in Hong Kong between 1987 to 1990 during which the school went through the change process from initiation to institutionalisation in CAA (see Section 7.4). The writer acted as a 'semi-participant-consultant' (explained in Section 5.3.4) to the school during the whole process of change. The details of this field work are presented in Chapter 7, together with the findings from interviews with three other local schools already using CAA to counter-check their management of the innovation against the proposed model. Management problems and concerns specific to CAA that were identified are discussed in this chapter too.

The thesis concludes with a final chapter containing discussions on the results, conclusions, and implications. It is the intention of the thesis to make an administrative contribution to the complex field of managing change, using CAA as an example, in schools in Hong Kong. It is hoped that the thesis can provide some practical approaches for reference to practitioners in Hong Kong who are managing school innovations or to those interested in school improvements.

CHAPTER 2

REVIEW OF LITERATURE I - SYSTEMS THEORY

2.0 INTRODUCTION

Changes do not take place in the void. They impact on either objects, people, organisations, or a combination of these. In other words, they are targeted on some 'systems'. The word 'system' has come into such common usage in all disciplines that it is difficult sometimes to pin down what exactly one means in using the term. It would be close to impossible to find this word omitted from a book on organisation or change.

The words 'systems' and 'sub-systems' are frequently used in the thesis. Some major concepts from systems theory do contribute to this piece of empirical work: including holism, synergy, open systems, and cybernetics (feedbacks). It must be clarified though that the thesis is not one based on what is commonly called systems analysis approach using an input-output model. There is much controversy between the approach of systems analysis and the phenomenological approach (which views events through the meanings that the actors involved give to them). Howell & Brown (1983), for example, took a positive view of systems analysis in applying the Eastonian model in their study of educational policy making. The writer, however, considers systems analysis as a subset only within the general systems theory and sees no conflict in using the phenomenological approach in managing change within a general systems perspective (see Sections 5.1.3, 6.5.2 & 6.5.3).

From the literature review on current perspectives of managing change (Section 3.11), it will be seen that 'people' is a crucial factor. Also in the cybernetic

model proposed in the thesis for managing the CAA innovation in schools (Sections 6.6 & 7.6.3), much emphasis is put on the subjective meanings of the actors about the innovation (Fullan, 1982, 1991). It is possible, or even necessary in the opinion of the writer, to manage change with a holistic vision through cybernetic phases (a systems view) using an 'action approach subroutine' (Section 6.6.1). As Fullan (1991) has written,

"Neglect of the phenomenology of change - that is, how people actually experience change as distinct from how it might have been intended - is at the heart of the spectacular lack of success of most social reforms." (Fullan, 1991:4)

More is discussed in Section 5.3.1 about this phenomenological approach, or 'action approach' according to Silverman (1970), to clarify the writer's use of the term 'action approach subroutine'.

2.1 SYSTEMS & ORGANISATIONS

There is in fact such a plurality of systems approaches that Lockett & Spear (1980) refrain from defining what is, or is not, a 'genuine' systems approach in the book they edited -- "Organizations as Systems". They attempt instead to extract the underlying factors in systems thinking which include (1) holism; (2) open systems; (3) inter-disciplinary approach; and (4) applied emphasis.

Following is a list of definitions on 'system' as extracted from the literature:

1. "A system may be simply defined as a complex of elements in mutual interaction." (Griffiths, 1964, in Miles (ed.), 1964:428)
2. "(A system is) any recognizably delimited aggregate of dynamic elements that are in some way interconnected and interdependent and that continue to operate together according to certain laws and in such a way as to produce some characteristic total effect. A system, in other words, is something that is concerned with some kind of activity and preserves a kind of integration and unity; and a particular system can be recognised as distinct from other systems to which, however, it may be dynamically related. Systems may be complex; they may be made up of interdependent sub-systems, each of which, though less autonomous than the entire aggregate, is nevertheless fairly distinguishable in operation." (Allport, 1955:469)

3. "A system is a set of objects together with relationships between the objects and between their attributes." (Hall & Fagen, 1956:18)
4. "A working definition (of system) for our purposes might be: a bounded collection of interdependent parts, devoted to the accomplishment of some goal or goals, with the parts maintained in a steady state in relation to each other and the environment by means of (1) standard modes of operation, and (2) feedback from the environment about the consequences of system actions." (Miles, 1964:13)
5. "A thing is called a system to identify the unique mode by means of which it is seen. We call a thing a system when we wish to express the fact that the thing is perceived/conceived as consisting of a set of elements, of parts, that are connected to each other by at least one discriminable, distinguishing principle. A system is therefore an interaction between what is 'out there' and how we organize it 'in here'. 'System' denotes an interaction between the objective world and how it is looked at or thought about; it denotes a mode of perceptuo-cognito organization." (Jordan, 1968, in Emery (ed.), 1981:24)
6. "A system is an organized or complex whole: an assemblage or combination of things or parts forming a complex or unitary whole." (Kast & Rosenzweig, 1970, in Open Systems Group (ed.), 1985:44)

Within the social system, therefore, the educational system is a part; and within the educational system there would be different educational institutions, legislations and regulations, various structures, people, and the like considered as subsystems. At the institutional level, Leavitt's consideration of an organisation as a multivariate system consisting of four elements (or subsystems) is a handy and useful one (Leavitt, Dill & Eyring, 1973:9). The four subsystems being tasks, technology, structure, and people (see Section 6.5.3). Thus the school's subsystem of tasks would include aims and objectives, both long-term and short-term ones as well as many sub-tasks. Its subsystem of technology would range to include things like premises and equipment to methodologies of teaching. The subsystem of structure would entail systems of work flow, communication channels, patterns of decision-making, co-ordination mechanisms, etc. Finally, the 'people' subsystem would include not only people within the school, obviously pupils and teachers, but parents too and even 'outsiders' such as interest parties.

2.2 SOME PROPERTIES OF SYSTEMS

A major emphasis in systems approach is the holistic perspective, and the most commonly known concept concerning holism of a system is -- "The whole is more than the sum of its parts." To distinguish a whole clearly from an aggregate, Angyal (1941) elaborated on this principle and suggested that it be modified in the following way:

"... aggregation and whole formation are processes of an entirely different order. ... in an aggregation the parts are added, in wholes the parts are arranged in a system. The system cannot be derived from the parts; the system is an independent framework in which the parts are placed." (Angyal, 1941, in Emery (ed.) 1981a:37)

Thus in a system of interrelated, interdependent parts, not only do the properties of individual subsystems matter, of more significance are the interactions among the subsystems totally contributing to the function of the whole.

A second property of a system is its constituency. While any system is a set of parts, itself is but a subset of a larger system. Griffiths puts it this way:

"All systems except the smallest have sub-systems, and all but the largest have supra-systems which are their environments." (Griffiths, 1964, in Miles 1964:428)

A third property of a system is its degree of 'openness', which depends on how permeable the system boundary is to its surroundings. This distinguishes an 'open system' from a 'closed system'. It was this rigorous distinction of L. von Bertalanffy (1950) between open and closed systems that led to the widespread interest and development of the General Systems Theory. According to Bertalanffy, open and closed systems are distinguished in the following way:

"From the physical point of view, the characteristic state of the living organism is that of an open system. A system is closed if no material enters or leaves it; it is open if there is import and export and therefore, change of the components. Living systems are open systems, maintaining themselves in exchange of materials with environment, and in continuous building up and breaking down of their components." (Bertalanffy, 1950 in Emery (ed.), 1981a:83)

The distinguishing criterion between open and closed systems is thus existence of exchanges with the environment. The concept has been extended to cover social systems. While an open social system is related to and communicates with its environment, a closed system does not make exchanges with what is external to it. Closed systems are in effect 'isolated' systems. In a sense, systems can be 'closed' only to the effect that their internal structures and activities are opaque to the external observer because they are enclosed by impenetrable boundaries. In the realm of social systems, it would be quite impossible to find totally closed systems. It is more appropriate to talk about the 'degree of openness' for such systems like organisations and schools.

In other words, totally isolated systems do not exist. Any humanly known system would have to be interacting with its environment, exhibiting its influence and demonstrating its function. Thus the commonly cited 'input-process-output' model of a system can be interpreted simply as a description of (i) external interactions with the environment -- input and output; and (ii) internal interactions among the subsystems -- process.

2.3 CLASSIFICATION OF SYSTEMS

In natural sciences, where the concept of systems originates, there are two general classes of systems: mechanistic and organic. When the idea is transferred to social settings, analogies are made quite naturally based on the same distinction. The input-process- output model is very often applied to organisations, such as factories, and even to schools. This simplistic model has its merits in focusing the area for attention, and is helpful in particular for activities like problem-solving, monitoring and evaluation. In practice, of course, social systems are much less predictable and controllable in contrast to simple physical or biological entities. The fact that people are an important subsystem in all social organisations necessarily complicates any attempt to describe or understand the working of social systems.

Pointing out that "there are many different kinds of connectivity which enable man to group entities together to form a system", Jordan (1968) proposes a possible taxonomy for social systems basing on three bipolar dimensions:

(a) Structural vs functional (or static vs dynamic):

Structural (static) phenomena are those aspects that do not change within a defined and delimited time span, while functional (dynamic) ones do. A system would be considered as static during a given period if the connection between the elements comprising the system can be reflected by the system's state at any one instant within that time. On the contrary, if at least two instances within the period are necessary for the connectivity to be demonstrated, the system is dynamic.

(b) Purposive vs non-purposive:

What characterises the pattern of action described as 'purposive' is the convergence to a terminal state that is called the 'goal'. As Jordan explains, this convergence seems, to a considerable degree, to be independent of the vicissitudes of the external environment. The growth of man's knowledge about its environment makes it possible for him to contrive purposive systems of increasing complexity. Jordan identifies the characteristics of such systems by (1) an input to the system, (2) a processing of the input by the system, and (3) a consequent output that consists of the input as modified by the system. This output is the goal which man desired to achieve by the system. Whereas non-purposive actions of physical objects obey the second law of thermodynamics resulting in an increase of entropy, goal-directed activities do not. Furthermore, purposive actions can either be directed towards the environment, or towards the system itself.

(c) Mechanistic vs organismic:

Jordan distinguishes mechanistic from organismic systems by considering the effect of changing, removing, or extirpating system entities and/or the connections between them. In his own words,

"A system in which the remaining elements, and their connections, undergo no change with removal or extirpation is perceived as being intrinsically different from a system in which they do. In the former case I will call the system 'mechanical'; in the latter case I will call it 'organismic'." (Jordan, 1968, in Emery (ed.), 1981:26-29)

Jordan's taxonomy of systems resulting from a combination of the above-suggested dimensions is thus a block with eight categories:

1. Structural, Purposive, Mechanical;
2. Structural, Purposive, Organismic;
3. Functional, Purposive, Mechanical;
4. Functional, Purposive, Organismic;
5. Structural, Non-purposive, Mechanical;
6. Structural, Non-purposive, Organismic;
7. Functional, Non-purposive, Mechanical;
8. Functional, Non-purposive, Organismic.

Since social organisations are all established supposedly for some purposes, they would fall only into one of the above first four categories.

An understanding of Jordan's classification is helpful in the case of CAA, particularly for the appreciation of the software design. Since the programs written for CAA will be targeted for some specific purposes, whether administrative or managerial, only the first four categories are applicable. In the opinion of the writer, whether the software system is structural (static) or functional (dynamic) is dependent on the stage of development of the CAA innovation system (see Section 6.5.2 for details of the four systems in an innovation). During the initial stage of software system development, the software will be unavoidably dynamic in the sense that user feedbacks should be taken into account for adjustment and/or enhancement. The software system can be described as static only when the innovation as a whole has been institutionalised (see Section 6.6.3) and no further change is necessary.

The concept of mechanistic versus organismic system is also of importance in the software design. In the language of computer programming, this may be interpreted as the degree of integration of the software produced. A software system may be described as task/application-oriented or integrated (see Section 4.4),

depending on the architecture of its design. The ideal of having an integrated CAA system (single-entry multiple-use) should be based on a modular (mechanistic in Jordan's term) structure such that certain tasks are not inhibited unnecessarily by the dysfunction of others.

2.4 DELIMITATIONS ON SYSTEMS APPROACH

The development of systems ideas in social science is not without flaws. Lockett & Spear, for instance, (1980:11) have pointed out two major drawbacks in the historical development of certain systems concepts within the structure of our economic and political system. The first criticism is the over-extension of the 'organic analogy' between complex biological organisms and organisations on their apparent similarities. "Most notable", as these writers have said, "has been the neglect of meaningful human action as a valid theoretical category in favour of structural and/or functional analyses, although this neglect has been recognised amongst more recent writers." (Lockett & Spear, 1980:11). David Silverman (1970) is one such writer, whose alternative 'action approach' is also one of the main structures to be used in this thesis to be discussed later in Chapter 5.

The other criticism is that applied systems approaches have often led to a rather uncritical identification with the currently dominant centres of power in society. While not implying that many systems ideas are 'conservative', it has been rightly pointed out that the development of applied systems approaches has tended to have a managerial bias. Lockett & Spear illustrated this tendency with the example of the attention often given to management information systems in contrast to workers' information system in organisations. A parallel can be drawn here also with the danger of having a managerial bias in planning change as Fullan (1982) explains:

"One of the initial sources of the problem is the commitment of reformers to see a particular desired change implemented. Commitment to what should be changed often varies inversely with knowledge about how to work through a process of change. In fact ... strong commitment to a particular change may be a barrier to setting up an effective process of change." (Fullan, 1982:82)

Some school policy-makers often overlook the fact that there are many incongruent versions of what should be done, with each subsystem viewing their version as the right one. And even if the conflict of values can be resolved, there still remains the problem of which set of procedures to be adopted. A bias of focus, not only on the managerial component but on any one subsystem, does not at all address real problems in change. It is a violation of the holistic view of systems thinking in doing that.

A possible cause leading to the two off-tracked paths in systems approach has to do with the concept of the boundary of a system. Bertalanffy made a great step in advancing from closed systems to open systems, but the idea of organisms with a boundary - though permeable and allowing exchanges with the environment - needs further extension when applied to social settings. In the case of a biological body, it 'owns' what is within its enclosure; whether that is a membrane, a shell, or an envelop in the form of skin. A social body, in contrast, does not have such total ownership. Organisations in our society can have only 'shared' members who may belong to many different social systems at any one time.

The concept of boundary for a social system is therefore a difficult one. For a physical system, we commonly identify its boundary at the extremities of its material extension. However, depending on the problem in mind, there is difficulty sometimes in defining boundaries even for physical systems. For instance, consider the case of turning a piece of soft iron into a magnet. The boundary of the magnetic field it now possesses is more difficult to define. We can only roughly define this boundary in terms of the 'span of influence'; and, provided we know the inverse-square law, we satisfy ourselves at the point where the magnetic field is too weak to have any significance for some purpose.

For open social systems like schools, 'boundaries' are more fictitious and artificial rather than real. The boundary concept is then useful only because when we cannot study or manage everything simultaneously in a social system, we can draw conceptually boundaries around the units we focus upon in the process of a certain

analysis. In other words, a system is defined with its boundary by a situational decision related to the purpose of the study (or of the undertaking, such as a change), and may vary over time. Boundaries are thus being drawn and redrawn around subsystems or entities, according to their 'span of influence' as relevant to the subject.

A fluid, dynamic systems view is taken in this thesis of managing change. The target subsystems to be changed are defined only situationally pertinent to the innovation as well as to the different stages of the change process (see Section 6.6.1 on the concept of 'Relevant System in Focus', RSF).

CHAPTER 3

REVIEW OF LITERATURE II - EDUCATIONAL CHANGE & INNOVATION

3.0 INTRODUCTION

The intention of the thesis in its infancy in 1985 was limited in scope to the study of computer applications in school administration. While such an objective could contribute undoubtedly to the knowledge base of how computers are being used or can be used to aid administration in schools, it is nevertheless a technological more than a managerial issue. Given the proper hardware and software system for CAA, does it by default mean that any school can implement the innovation successfully? This was the leading question that drove the writer to study the management of change and innovations in schools, with particular emphasis on the managerial issues during the process of 'implementation'.

Before stepping into the field of educational change, the writer needed an in-depth understanding of what other writers and prominent researchers have done in the area. This helped not only to prepare the research plan but also the formulation of the process model of innovation in the study.

This chapter covers a wide range of literature about change and innovation. The first sections review major concepts about educational change between the 1960s and 1970s. Studies and research on educational change of such times were mainly analytical. Efforts then concentrated mainly on identifying factors pertinent to change, on categorising different change models, and on implementation strategies. In the 1980s a number of studies on excellence and success in business firms (see Section 3.11), as well as in public services like the NHS (National Health Services,

U.K.), has shifted the emphasis to the instrumental side of managing organisational changes. These current perspectives are reviewed in the last two sections of this chapter and their relevance to educational institutions is clearly reflected. An understanding about the 'classical' theories of change, together with the modern concepts of changing, helps much to shape and guide the researcher's approach in managing the CAA innovation case in this study.

3.1 EDUCATIONAL CHANGE & INNOVATION

In the opinion of the writer, an ultimate goal in the world of physical as well as social sciences is in the search for 'rules' of change. In the realm of the former, the major concern is on the behaviour or reaction -- that is, change -- of objects or matter under certain environments. Such events of change which scientists seek to understand are usually predictable and are expressible in mathematical terms and concrete formulas. In social sciences where the subjects of study are human beings, organisations or social structures, changes are much less quantifiable and controllable. Research in educational change and innovations belongs to this category.

Educational change has a broad scope. Studies in this area have a wide range from the macroscopic countrywide policy-making (e.g. Dalin et al., 1973) to the microscopic teaching in the classroom (e.g. Hall & Hord, 1987). Issues can cover curriculum, teaching methods, technology, roles and people, as well as organisation and administration. In the writer's view, all current studies tend to be directed at one main objective -- improving schools.

To discuss 'change' and/or 'innovation', and their management in education, it is appropriate to start by distinguishing the meanings of these two terms as found in the literature on the subject.

A generally accepted definition of 'change' is a simple one given by Guba (1968) as follows:

"There are some perceptible differences in a situation, circumstance or a person, between some original time t_0 and some later time t_1 ."
(Guba, 1968:1)

In other words, we can picture a change as the transition from a certain state s_0 to a different state s_1 over time marked by t_0 and t_1 as follows:

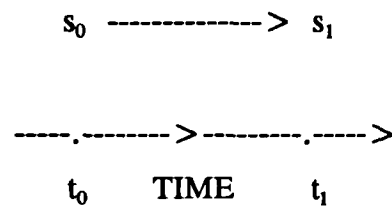


Figure 3.1 Change as a Transition

With more specific reference to organisations, Griffiths (1964) considers any alteration in an aspect related to the organisation to be a change. To him,

"The word change is used to mean an alteration in the structure of the organization, in any of its processes, or in its goals or purposes." (in Miles (ed.), 1964:428).

To make this definition complete, any alteration in the people aspects in the organisation should also be included.

'Innovation', on the other hand, is often viewed as one special kind of change (Miles (1964) called it a species of the genus 'change'). Marklund (1972) made a clear distinction between educational innovation and change:

"The term innovation as used in school and teaching is often synonymous with the term change. If this change is on a broad scale and affects an entire school system, one frequently speaks in terms of a reform. It would be incorrect however to refer to every change as an innovation. It must imply an improvement towards a pre-determined objective. Innovation always presupposes one or more qualitative criteria." (Dalin, 1973:6)

The study focus for educational innovation varies much. While some researchers concentrate on the 'quality' aspect, others emphasise 'operationalisation'; some concern themselves with 'barriers' and 'resistance', leaving others adhering to a 'process' view. These varieties can be observed from the various definitions collected that follow.

Barnett (1943), thinking about the 'quality' aspect, defines 'innovation' in the following way:

"Innovation is any thought, behaviour or thing that is new because it is qualitatively different from existing forms." (in Dalin, 1973: 34)

Other definitions, focusing on the 'operationalisation' of innovation rather than the quality, include that given by Beal and Bohlen:

"A change which involves not only a change in materials but also a complex of changes with regard to their use." (Beal & Bohlen, 1968: 55)

Other writers describe innovation as a process. For example, Neihoff considers innovation as:

"A process that begins with an idea on the part of a change agent and ends in its adoption or rejection by the potential recipients." (Neihoff, 1966: 40)

Similarly, Richland, with a process view of innovation, defines it as:

"A creative selection, organisation and utilisation of human material resources in new and unique ways which will result in the attainment of a higher level of achievement for the defined goals and objectives." (Richland, 1965:32)

Brickell, in his process definition of educational innovation, also implies a goal-directed or value-directed improvement in the use of the term:

"The entire process of generating a new form of educational practice (along with the concepts underlying it and the materials needed to execute it), trying it in small-scale laboratory settings to get information for the purpose of redesigning it, testing it in a variety of field settings (to discover what it will do under normal conditions, and disseminating it to prospective adopters (to inform and aid them in adopting it). Adoption, which must accompany dissemination (dissemination is sending; adoption is receiving), is also included in the definition." (Brickell, 1961:61)

Goal or objective oriented definitions of innovation appear to have a firm stance especially in education. Thus Miles notes that:

"Generally speaking it seems useful to define innovation as a deliberate, novel, specific change, which is thought to be efficacious in accomplishing the goals of a system." (Miles, 1964:14)

Dalin et al. in their international case studies of educational innovations, use the term innovation to mean:

"A deliberate attempt to improve practice in relation to certain desired objectives." (Dalin, 1973: 36)

This simple and concise definition of Dalin's clearly identifies three important characteristics of an educational innovation, that

- (1) it is a deliberate and planned activity or process;
- (2) it is goal-oriented;
- (3) it is intended for improvement over existing practice.

3.2 ORIGIN/SOURCE OF EDUCATIONAL CHANGE

In the management of change, context or environment is an important factor. The question of whether the scene has been properly set for an innovation undoubtedly affects the chance of success. In the case of the CAA innovation, Shaw & Lancaster (1986) differentiate the concept of 'technology-push' (i.e. environmental in origin) from that of 'needs-pull' (i.e. internal in origin). These authors have recommended that schools should identify objectives and the areas of administration for computerisation to avoid 'technology-push' administrative change (Shaw & Lancaster, 1986).

In studies and research on educational changes, some early writers (e.g. Levin, 1974; Stiles & Robinson, 1973; Coleman 1973) tended to identify the origin or source of the change. Probably the logic was that once the origin was located, an explanation of the cause of the change could be given according to existing theoretical

approaches. A distinction is generally made in the cause of a change between 'external' and 'internal'. The former asserts the environment as the source of change stimulus, while the latter assumes origination from within the educational system itself.

Fullan (1982), supporting the view of Levin (1974), considers three broad ways in which major external and internal forces over time create pressures for educational change:

- (1) through natural disasters such as earthquakes, floods, famines, etc.;
- (2) through external forces such as imported technology and values, and immigration; and
- (3) through internal contradictions, such as when indigenous changes in technology lead to new social patterns and needs, or when one or more groups in a society perceive a discrepancy between educational values and outcomes affecting themselves or others in whom they have an interest, i.e. educational changes are often political in origin. (Fullan 1982:13)

Zaltman, Florio, and Sikorski (1977:53) have remarked that it has been widely acknowledged that most changes in education are externally generated (Stiles and Robinson 1973; Coleman 1973; Levin 1974; Carlson 1965) while others disagree with this position (Giles, Gatlin, and Cataldo 1974).

In the opinion of the writer, there can be no settlement on this either/or type of argument. Even if one side has 'won', there still remains the more fundamental question of "what then?" to be pursued. In other words, one still has to attend to the more important question of implementation. To quote Zaltman et al.,

"It is somewhat fruitless to attempt to distinguish between the chicken and egg of social and institutional change. We are a society of groups, organizations, and interlocking systems. To argue that one system is always or nearly always relegated to a reactive status in relationships with others and with the broader social system is to neglect the reciprocal nature of social change among institutions. Systems thinking highlights the interaction among subsystems." (Zaltman et al., 1977:54)

In summary of the previous discussion, it is the writer's view that in the management of change, a systems perspective (see Chapter 2) can be adopted. A holistic view is to consider a system under change be embedded in a suprasystem (the environment) with mutual interaction between them, and with internal interactions within the system itself amongst its subsystems. Interaction between a system and its environment can be furthermore distinguished as reactive and proactive. It is important to point out the capacity of human systems to proact as well as react. This is to realise the ability of man changing society as well as society changing man.

It is necessary to distinguish between changes that come about as a result of environmental demands in which the organisation or system seeks to adapt for equilibrium, and self-initiated changes (i.e. innovations) where there is a deliberate move towards some desired future state chosen by people representative of the system. The management of change, as Beckhard puts it, is the managing of this change process - "the transition state" - moving from today's condition to some desired future state. (Beckhard & Harris, 1977: ix).

In the case of CAA in Hong Kong schools, for instance, there is neither pressure nor support from the central education office for the change. Schools that have started CAA, including the schools serving as cases in this study, can be considered as innovating proactively. Needless to say, such schools are also subject to demands from the environment, in terms of say the increasing amount of work-load imposed on teachers nowadays in Hong Kong, and their CAA innovation might as well be considered as a kind of reactive change in that sense.

3.3 INHERENT NATURE OF CHANGE

To manage change with success in an organisation, one inevitably needs an understanding of the inherent nature of change. With such knowledge the change manager will be better prepared to identify and solve problems that might arise during the change process. Three key concepts about change are identified in this section: (i) do not innovate just for the sake of innovation; (ii) uncertainty is inherent in social

change and so the provision of as much information as possible will guarantee a better chance of success, especially during the initiation phase (see Section 6.6.1); and (iii) remember the importance of people concerned.

Havelock (1971), in discussing the inherent nature of innovations in education, gives a clear view of the value of such activities:

"There is no inherently valuable or good in innovation, as such. We innovate whenever we try anything new, when we inhale a cigarette for the first time, when we first teach a class without bothering to prepare for it, or when we discover that we can cheat on a test and get away with it. Usually, of course, when we use an expression like 'innovation in education' we think we are talking about something more positive, a change for the 'better', or something that is both new and beneficial. Even so, we may have a tendency to slip into the assumption that something is good because it is new or different from what we have done before. Many observers have noted that education (in the United States) is prone to this sort of faddism, the mass adoption of one innovation after another without regard to either its demonstrated value or its potential consequences, positive or negative." (in Dalin, 1973:35)

It is clear from the above that what matters is the meaning and purpose that we, as human actors, give to innovative attempts in education to make them of value. A phenomenological approach is thus necessary in the management of change according to this classical line of thought. This concurs also with the emphasis on 'people' in the current perspective of change (see Section 3.11.3).

Another aspect inherent in change or innovation is very well agreed upon by most theorists and practitioners of change -- risk and uncertainty. It is sufficient just to quote a few here to clarify the point.

"Change typically involves risk and fear", says W.G. Bennis, "any significant change in human organization involves rearrangement of patterns of power, association, status, skills, and values. Some may benefit, others may lose. Thus change typically involves risk and fear. Yet change efforts sometimes are conducted as if there were no need to discuss and 'work through' these fears and worries." (Bennis, 1965, in Bartlett & Kayser (ed.), 1973:71)

Schon has developed essentially the same theme. All real change involves "passing through the zones of uncertainty ... the situation of being at sea, of being lost, of confronting more information than you can handle." (Schon, 1971:12)

Similarly, innovative activities as risky activities is an observation made by Fullan (1973) in the Thornlea case study :

"This is another way of saying that innovation is a risky business and must be recognised as such. We think that the people at Thornlea have shown this recognition. The short history of the school has reflected an approach to education in which promising ideas are seen as worth trying. The problems encountered along the way are seen as a natural part of the pursuit of better ways of doing things. We think that any innovative organisation must have this ability to recognise that problems are inevitable and that growth can only occur by treating problems openly and with respect as experiences to be learned from." (Fullan, 1973:190)

Risk, fear, and confusion are all related to the uncertainty that change causes to the people concerned. People feel insecure when they are not clear about what is to happen. It is worth diverting here to look closer at what brings about uncertainty.

Galbraith (1973:5) identifies very clearly the relation between 'uncertainty' and 'information lacking'. To quote him,

"Uncertainty is defined as the difference between the amount of information required to perform the task and the amount of information already possessed by the organization. Thus the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers during its execution. If the task is well understood prior to performing it, much of the activity can be preplanned. If it is not understood, then during the actual execution of the task more knowledge is acquired which leads to changes in resource allocations, schedules, and priorities. All these changes require information processing during task performance. Therefore the greater the task uncertainty, the greater the amount of information that must be processed among decision makers during task execution in order to achieve a given level of performance."

It sounds a circular way to say that risk and fear are caused by uncertainty which in turn is due to a lack of information about the task in a changing situation.

In fact it is not, for at least we are clearly led to the necessity of searching for situational information if we want to reduce uncertainty when undergoing a change. The need for relevant information is recognised more and more these days by managers and administrators in any organisation, both in their daily maintenance function and in forward planning and decision making.

Information management is therefore one significant aspect in the management of the transitional process from the present to the desired future state in any innovation.

3.4 WHY INNOVATIONS FAIL

Fear of the unknown, as indicated in the previous section, is one major reason why change is not a welcoming activity. This is because of the intrinsic human nature of detesting failures. Ironically, however, past experience of failures can contribute to future success. An often quoted Chinese saying is that "Failure is the mother of success". People with a positive mind learn from mistakes and this section reviews some of the failing factors in educational innovations as pitfalls to be avoided.

Dalin has remarked that "since innovations are seldom 'good' for everyone it would be easy to find 'failures' in any innovation" (1973:232).

It is indeed very true that innovations, being complex processes over time in an ever-changing setting, are liable to failure at every possible stage from start to end. Literature abounds on why innovations fail, with different writers picking up faults where they please along the tricky route of any innovation. Some put the blame on 'climates', others complain about the ingredients not being 'ready'. While still others focus on 'adoption', there are many who concentrate on 'delivery' or 'implementation'.

Following is a list of quotations as pointers to reasons of innovation failures drawn from just two writers on educational change, but enough to show the multifarious state of affairs:-

- * "Failure to develop an adequate design for implementation" -- (Fullan, 1982:15)
- * "Technical problems in the management of change and questions about the development soundness of the innovations themselves" -- (Ibid.:15)
- * "Assumed without any reflection that 'progressive innovations' were good, and that only problems of delivery interfered" -- (Ibid.:15)
- * "Educational changes are adopted piecemeal without any thought as to whether the sum total of what is expected can feasibly be implemented" -- (Ibid.:21)
- * "Understanding why most attempts at educational reform fail goes far beyond the identification of specific technical problems such as lack of good materials, ineffective in-service training, or minimal administrative support. In more fundamental terms, educational change fails partly because of the assumptions of planners and partly because some 'problems' are inherently unsolvable." -- (Ibid.:81)
- * "Usually the cause is a lack of understanding of political, legal, administrative and financial constraints, including the in-built reward and punishment structure, all of which have been created to maintain the existing system and not to serve an innovative function." -- (Dalin, 1973:19)

Another way of looking at causes of failures in innovation is to consider "barriers" in the change process. An innovation will fall flat naturally if any of these barriers cannot be removed or hurdled over. For example, some major barriers to innovation identified by Havelock & Huberman (1977) include:

- Underestimating the process
- Personalities and personal motivation
- Underdevelopment (Inadequate resources & capacities)
- Financial problem
- Opposition from key persons
- Poor social relations.

Dalin (1973) has also discussed a number of barriers to change and remarks that "it has been said that most innovations fail because they are not good enough. We do not know if this statement can be verified, but many barriers can be traced back to relatively 'simple' practical problems", these include:

1. Time
2. Knowledge
3. Level of Organisational Development
4. Integration of Incentives
5. Multiplicity and Specificity of Objectives
6. Resources
7. System Implications. (Dalin, 1978:30-35)

Understanding of failures and barriers of innovation does help in the managing of change. It is important for the administrator or the change agent to have as clear a picture as possible of what constraints to work 'within' and what barriers to 'work over'.

3.5 A TYPOLOGY OF INNOVATION FACTORS

The complexity and difficulty involved in an innovation process can be easily recognised simply by looking at the diversity and large number of related factors. There are factors identified as barriers to change, factors which are conditions for adoption, and factors related to the process of change. As Hurst has remarked after his review of literature,

"Researchers have discovered a very large number of factors which are apparently or allegedly correlated with the process [of innovation]. There are at least 60 extant examples of one type of correlation alone, and Zaltman et al.(1977) refer to some 300 variables as being potentially involved." (Hurst, 1983:5)

It would be difficult enough for a change agent just to remember such a large number of factors in an innovation, not to say manage them. A more practicable alternative is to use a typology instead and one is suggested here which hopefully can serve as a kind of map-guide for a change agent to gain a broad perspective of major innovation factors.

In this typology, factors pertaining to an innovation are broadly classified into one of the following three categories:

- (1) Knowledge & Skill factors;
- (2) Resource & Support factors;
- (3) Human & Social factors.

The management of an innovation may be interpreted as a deliberate attempt to deal with the interactions among the user system, the innovation system, and the change agent system with regard to these three categories of factors to achieve certain objectives. (See Section 6.5.2 for a more detailed explanation of the systems involved in an innovation).

Innovation factors identified by various writers discussed earlier can possibly be fitted into one of these three categories. The essence of this typology rests on the understanding of the relationships of the three major constituents (knowledge and skill; resource and support; and 'people' attributes) regarding the user; the innovation; and the change agent systems. In the writer's opinion, any implementation of change is working, consciously or unconsciously, within this typology.

3.6 MODELS OF CHANGE

The term 'model' is used in a loose sense in this context, including different approaches to innovation or change as found in the literature. Contributors to this area include Bennis (1963), Chin (1967), Lippitt et al. (1958), Havelock (1969), Bolam (1974), Dalin et al. (1973), and other more current writers like Turrill (1986), Hall & Hord, (1987), and Fullan (1982).

In this section only the classical models are presented, and the more current views are left for discussion in Section 3.11 about the current perspectives on change. The classical models of change have been broadly distinguished into two classes - general models and process-oriented models. These are discussed in the following Sections 3.6.1 and 3.6.2 respectively and followed by Section 3.7 on the classical strategies of implementation.

3.6.1 GENERAL MODELS

Bennis (1963) identified three general classes of change models:

- i) **Equilibrium models:** The target system is being considered as a defensive social structure. Utilising strategies involving tension release through anxiety reduction, the goal is to attain a conflict-free social structure.
- ii) **Organic models:** The target system is being considered as a problem-solving entity. Power redistribution and conflict resolution are the strategies involved and the goal is team management.
- iii) **Development models:** The target system is the people in the system. By developing personal and interpersonal competence and transformation of norms and values, the goal is to achieve co-ordination with authentic relationships. (Bennis, 1963:144)

Chin (1967) also has identified four different classes of change models three of which are much the same as those discussed by Bennis, namely 'systems and component models', 'organic system models' and 'development models'. His fourth category called 'inter-system models' refers specifically to changes that do not aim at a new equilibrium, but rather at a state of dynamic dialogue between interest groups. (Chin, 1967:336-338)

3.6.2 PROCESS-ORIENTED MODELS

A number of authors have developed process-oriented models for change in social systems. Many models focus on the relationship between a change agent and the client/user system, as well as employing a problem-solving strategy. For instance, the Lippitt-Watson-Westley model has the following seven stages:

- (1) the development of a need for change;
- (2) the establishment of a change relationship;
- (3) the clarification or diagnosis of the client system's problem;
- (4) the examination of alternative routes and goals, establishing goals and intentions of action;

- (5) the transformation of intentions into actual change efforts;
 - (6) the generalisation and stabilization of change;
 - (7) achieving a terminal relationship.
- (Lippitt et al., 1958:131-143)

Havelock (1969) has devoted much effort in studying a large number of innovations and his classification broadly distinguishes three models of change:

- i) The R-D-D model: This mainly encompasses the production of new products by a central agency or institution. As a result of research, materials are developed, packaged and disseminated to the target systems for use.
- ii) The Problem-Solving model: This is similar to the Lippitt-Watson-Westley model where an innovation goes through the traditional problem-solving cycle.
- iii) The Social-Interaction model: This model considers the process of innovation diffusion through the social system where different potential users interact and an innovation gets transmitted.

In addition, Havelock has also proposed a 'linkage' model in which sub-systems of research, development, practice and consumption are connected to one another by two-way influence and dialogue on both needs and solutions. In this 'linkage' model, successful innovation depends on the ability of both user groups and resource groups to understand each other and co-ordinate their behaviour for common goals. (Havelock, 1969, 1970)

Dalin and his group of researchers, in their international case studies of educational innovations, used a process-oriented innovation model closely related to some of the models mentioned above. The following steps are included in their model:

- (1) Problem identification and definition;
- (2) Innovation planning;
- (3) Innovation programming and development;
- (4) Experimentation;
- (5) Evaluation and revision;
- (6) Dissemination and production;
- (7) Implementation.

This is referred to by Dalin's group as the Planning, Research, Development and Diffusion model (P-R-D-D model). (Dalin, 1973)

It would be most appropriate to end this section by quoting Dalin: "Models which build on an assumption of neutrality, rationality and consensus about change are, in our view, unrealistic. The consequence of a non-political standpoint is not a 'professionalisation' of the matter, but rather to veil the realities of any change or innovation" (Dalin, 1973:54). In other words, perceptions of the people affected by an innovation is a critical issue to its success or failure, and H.A. Simon's (1959) concept of bounded rationality of the human mind has a close bearing in this regard.

3.7 STRATEGIES OF IMPLEMENTATION

Models of change, in one way or another, attempt to present a general picture of the change process and the stages involved. Details of situational constraints, whether internal or external, are not taken into account. Strategies, on the other hand, are specific plans and steps taken to effect a change in view of anticipated constraints and barriers, with the deliberate attempt to achieve success. According to The Third Area Conference on Strategies for Planning and Effecting Needed Changes in Education (Eight-State Project, Denver, Colorado, October 1966), strategies are defined as follows --

"Strategies of Change are interpreted as including, but not limited to, dissemination and provisions for utilisation of pertinent information regarding all aspects of the proposed plan; ways of identifying and dealing with internal and external (environmental) constraints as well as facilitating influences; ways of identifying potential opposition, conflicts and tensions and of resolving them advantageously; appropriate means of helping individuals, organisations and agencies to effect needed change in their perspectives; and procedures (guidelines) for implementing proposed change."

In a much more detailed form, Beckard & Harris explained the meaning of strategies and the complicated elements connected:

"We define a large-system change strategy as a plan defining what interventions to make where, by whom, and at what time in order to move the organization to a state where it can optimally transform needs into results in a social environment that nurtures people's worth and dignity. Managerially, this means defining the kinds of activities that need to be induced and the kinds of expertise that need to be brought to bear to help with the change; identifying people in the organization who need to become committed to the change; establishing a timetable and specifying priorities of changes and practices in procedures, rewards, policies, and behaviour; establishing a system of evaluating progress toward a new state; and providing education in skills needed to both operate in the new condition and manage the change." (Beckard & Harris, 1977:15)

Although strategies do vary depending on the scale of change, the nature of the innovation, and the organisations involved, there are also commonalities identifiable. According to Bennis, Bennis & Chin's (1969) typology, strategies can be classified into three categories:

- (1) *Empirical-rational*: this type of strategies holds the underlying assumption that man is reasonable and will act in some rational way to accept something new which is good. The primary task of the change agent, therefore, is to explain and demonstrate through the best known method the validity of a certain innovation in terms of the increased benefits to be gained from adopting it.

This distinction between the rational and irrational is too simplistic and Weick (1969) has argued that the notion of 'multiple rationalities' is closer to reality. The current view of managing change recognises the significance of culture and coalitions, much different from this simplistic empirical-rational approach (see Section 3.11.4).

- (2) *Normative-re-educative*: this type of strategies holds the basis that the central importance to the issue of change depends on how the client understands his problems. The primary task of the change agent is not a matter of supplying the appropriate technological information but

rather a matter of changing attitudes, skills, values and relationships. Training and re-educating people involved is thus the key. Acknowledging the client's value-system implies less manipulation from outside. Innovating is thus equivalent to activating forces within the system to alter it.

This strategy is more in line with current thinking on managing change where people and their value-systems are major issues that the change agent has to attend to (see Section 3.11.3).

- (3) *Political-administrative (Power-coercive)*: this type of strategies incurs use of authority or power. People are directed to act in certain ways as designed by the conditions imposed, by limiting the alternatives, or by shaping the consequences of their acts (Bennis, Bennis & Chin, 1969:34).

The political aspect in change is well recognised within the current perspective (see Section 3.11.4) with the qualification that power or authority need not be limited to that of position, but includes others such as expertise, information, even charisma.

Although strategies are discernible into categories as explained above, there is no implication that they are used necessarily in separation. More often than not, a mixture of them is involved in implementing an innovation.

Within the general typology described, strategies for specific innovations are often situationally targeted at particular objectives. The nature of a strategy is multivariate and different aspects have to be taken into account.

Guba (1967) suggested that any strategy would need a consideration of the following four elements or basic assumptions which are:

- i) Assumptions concerning the nature of the practitioner who will be exposed to the strategy.

- ii) Assumptions concerning the end state in which one wishes to leave the practitioner.
- iii) Assumptions about the nature of the agency or mechanism carrying out the diffusion activity.
- iv) Assumptions concerning the nature of the invention. (Guba, 1967:27)

In addition to the above, there is one major common element in all strategies for innovation. This is the conscious utilisation and application of knowledge. This knowledge may be a knowledge of "things" used in controlling some part of the environment, or it may be knowledge about people, which is used to help to understand the behaviour of individuals and groups in introducing innovations.

Because educational institutions tend often work to maintain the status quo, a primary concern in the innovating process would be the selection of a mechanism to loosen up the organisation or unfreezes frozen attitudes. Using Kurt Lewin's (1957) concept of force-field analysis, any strategy would incur the analysis of the forces favouring and resisting the change in the 'people' subsystem. Those people whose commitment is essential to the change must be identified, and they are to be involved in the process so that positive attitudes can be formed. The result is that much cost will be saved than if one were to force the change on those who are resistant to it.

3.8 TYPES OF EDUCATIONAL INNOVATION

Innovations are creative activities and the varieties and scopes are limited only by the human mind. Educational innovations cover a wide range of variations in their nature, their scope, and their objectives. For example, Miles (1964) groups educational innovations in eleven classes, organised according to the aspects of a social system with which the innovations appear to be most clearly associated:-

1. Boundary maintenance operations;
2. Size and territoriality;
3. Physical facilities;
4. Time use;
5. Goals;
6. Procedures;

7. Role definition;
8. Normative beliefs and sentiments;
9. Structure (relationships among parts);
10. Socialisation methods;
11. Linkage with other systems. (Miles, 1964:15)

Such a classification does not imply that any innovative item on the list can be introduced in isolation to the others. Miles did not fail to draw attention to the fact that "almost any given innovation is bound to have ramifying effects on many (or all) other aspects of the social system into which it is introduced." The complexity of an educational innovation can thus be well appreciated. In the writer's view, Miles's classification of types of educational innovation could well be taken as different dimensions of looking at any one innovation. In the case of the CAA innovation in this study, for instance, all eleven aspects listed are necessarily involved within the school.

From a different angle, another way of categorising educational innovations has been adopted by Dalin et al. (Dalin, 1973:39-41). Innovations are first classified into two levels - the general level and the institutional level. While the general level concerns the overall educational system including various levels and inter-relationships between levels, the institutional level concerns only the individual school and its environment. Within each level, an innovation can then be put into one of the four categories listed below depending on the major aspect of the system where change effort is targeted.

Category 1 -- *Objectives and functions:*

Innovations mainly concerned with the objectives and functions of the school in its broader social and economic context.

Category 2 -- *Organisation and administration:*

Innovations mainly concerned with the organisation and administration of the educational system; also included here are the control, the finance, the decision-making and the supply of logistics.

Category 3 -- *Roles and role relationships*:

Innovations mainly concerned with role definitions and role relationships.

Category 4 -- *Curriculum*:

Innovations mainly concerned with curriculum, its aims, content, methods, evaluation, material and internal organisation of instruction.

According to this categorisation, this thesis would belong to the institutional level primarily and falls in Category 2.

3.9 CAA AS AN EDUCATIONAL INNOVATION

Computer aided administration is an innovation in organisation and administration within the school. Within this category, change efforts are clearly concerned with the development and implementation of new practices ('procedures' in Miles's (1964) classification described previously) within a given policy framework. The CAA innovation is method or technology oriented, requiring special 'physical facilities' of hardware and software. This does not mean, however, that it is unrelated to objectives, nor is it value-free. On the contrary, it should be defined in terms of stated objectives and with an action plan to achieve them. It may not be the explicit intention of the CAA innovation to change existing educational values but rather to work towards these aims with improved methods and means, but unavoidably participants in the innovation will have their values adjusted during the process. In the course of such a change, there will necessarily arise needs for redefinition of administrative responsibilities, and change in roles and role relationships ('role definition' in Miles's (1964) classification).

In other words, as Dalin and associates (1973) have pointed out, there must be an inter-connection between Category 2 (Organisation and administration) and Category 3 (Roles and role relationships). The position is that, within the current

perspective of change (see Section 3.11.4), innovations are 'political' in the sense that they are value-loaded and influence, in one way or another, the lives of individuals in the organisation.

Dalin's classification of educational innovation is neat and tidy. Without too much complexity, it can provide a general view of what educational innovations are about. Similarly, Bolam says

"An innovation will usually focus upon a particular aspect of the target user system; upon, for example, aims, values or perspectives; organisation and administration; role relationships; curriculum, pedagogy and evaluation." (Bolam, 1974:73)

3.10 THEORIES OF CHANGE, OR OF CHANGING?

Irrespective of so many research and writings done on social change, there is not yet any firmly established theory to guarantee success in carrying out an educational innovation. Perhaps there never will be one. May be change is inseparable from uncertainty and thus we can at best only talk about the probability of success.

In Section 3.4 many reasons why innovations fail have been reviewed, but one major issue was left out for further discussion here. Innovations are prone to failure not only because we lack knowledge about the system in which change takes place and/or knowledge about the nature and technicalities of the innovation itself, but also because we do not have sufficient theoretical knowledge about the process of change. This was the picture of the 1970s, as Bennis has pointed out that we were lacking of a viable theory of social change, saying:

"Unfortunately, no viable theory of social change has been established. Indeed it is a curious fact about present theories that they are strangely silent on matters of directing and implementing change. What I particularly object to is that they tend to explain the dynamic interactions of a system without providing one clue to the identification of strategic leverages for alteration. They are suitable for observers of change, not for practitioners. They are theories of change, and not of changing." (Bennis, 1965, in Bartlett & Kayser (ed.), 1973:67)

A similar view expressed in a slightly different way is given by Hurst who says:

"It would be wrong to say that we know virtually nothing about the innovation process - we know a fair amount, but not enough to claim a widely reliable basis for practice. It would be truer perhaps to say that we know rather more than we understand. Researchers have discovered a very large number of factors which are apparently or allegedly correlated with the process. There are at least 60 extant examples of one type of correlation alone, and Zaltman refers to some 300 variables as being potentially involved. But while correlations are interesting to researchers, from an operational point of view they are only interesting if they are also (1) necessary or sufficient conditions (causes), and (2) manipulatable in some way." (Hurst, 1983:5)

Whether or not one can be definitive about 'necessary or sufficient conditions (causes)' of change, however, is quite an arguable issue. In any case, there has evolved since the 1980s some well accepted concepts which can provide a base-line for the change manager to act upon (see Section 3.11).

Interestingly, the problem of a lack of a 'theory of changing' had not been recognised by many who were in the business of change during the 1960s and 1970s - who worked in the field as if they possessed that knowledge. This was a problem of 'not recognising the problem'. This was the faulty approach to educational innovations as alluded to by Fullan (1982:84) -- that planners (whether they be policy-makers or developers of innovations) had not been sensitive to the need for a 'theory of changing'. Putting it more explicitly, Fullan says,

"I do not think that a detailed technical treatment on how to plan for change is the most profitable route to take, although such a treatment may have some benefit. The most beneficial approach consists in our being able to understand the process of change, locate our place in it, and act by influencing those factors which are changeable and by minimizing the power of those which are not. All of this requires a way of thinking about educational change which has not been characteristic of either planners or victims of past change efforts." (Fullan, 1982:88)

Fullan (1982, 1991) thus distinguishes a 'theory of change' from a 'theory of changing' in his basic premises of conceptualising the change process. The former assumes that people should be able to conceptualise the change process to be more effective, while the latter questions this very possibility. A 'theory of changing' does not concur with the possibility to alter (i.e. to increase) people's conceptual and organisational abilities merely by telling them what the concepts should be. Instead, the argument is that "Conceptualization must be integrated with the appropriate technical steps and human relations processes if it is to be useful; that is, it must be grounded in actual change events. Practical conceptual formulations can only be developed through experience and reflection" (Fullan, 1982:94).

This thesis has adopted an approach to study the CAA innovation with a spirit as described by Fullan in the previous paragraph. Theory is generated from field work rather than formulated first and subsequently tested (see Chapter 5 on Research Method). With such a stance in considering the process of change, it is readily seen that change is a learning process for the participants - both on the part of the users as well as the change agent. This is an important concept about change management further discussed in Section 3.11.2 when the current perspectives on change are considered.

Fullan (1982) further indicates that social change should never be treated solely as a rational, predictable phenomenon. Intuition, learning from experience, formulation and reformulation, getting something to work without necessarily knowing why it works - all have their place in planning and coping with change. With this line of thought, Fullan (1982:98) also suggests that instead of focusing on changing conditions which might not be changeable (except perhaps through prodigious effort), the most effective approach is to use different strategies in different situations. At every stage in a change process, what we do is contingent on the characteristics of the change being attempted and the situations at hand; and the concentration of the change effort is on those factors in that situation which are thought to be alterable.

This approach does require, then, the change manager to have a general knowledge of factors relevant and amenable to change. S/he will also have to possess or acquire the skills to assess to what extent factors conducive to implementation can be altered in favourable directions. The kind of techniques and skills that a successful change manager requires is further considered in Section 3.11.5.

3.11 CURRENT PERSPECTIVES ON CHANGE

The classical theories and approaches examined in the earlier sections have contributed much to the writer's understanding about educational change and innovations. These basics may be expressed as knowledge about the 'theory of change' and is only necessary but not sufficient for managing the CAA innovation in practice. What was needed by the writer was further knowledge about 'how' to manage the innovation process with success. In other words, a search for a 'theory of changing' from more recent literature was required. This was in line with what Fullan (1991:9) has pointed out, "many attempts at change fail because no distinction is made between theories of change (what causes change) and theories of changing (how to influence those causes)." The following sections on current views of managing change complement the previous ones in the writer's formulation of the proposed model of managing the CAA innovation presented in Chapter 6.

The 1970s saw many changes in organisations implemented in a planned or 'top-down' way. As Turrill (1986:10) pointed out, "we have in the past tended to think of change in packages, discrete projects or programmes ... which many perceive as being imposed by 'them' on us, that change has for most of us become a way of life." Since the 1980s there has been a shift of emphasis in management from the control model to the commitment model (Walton, 1985; Carnall, 1990). While the control model seems to produce reliable performance in stable circumstances, it has become clear that this is not enough in the fast-changing world of today. When competitive advantage can be gained only by high performance, a sustained high level of commitment from people in an organisation is required.

A body of knowledge about managing change has evolved over the past decade from studies on excellence and success in business organisations. Words like entrepreneurial or innovative enterprises are often linked to terms such as ownership, commitment, visionary leadership, culture and politics. Such works include, to name just a few, Kanter's (1983) *The Change Masters*; Peters & Austin's (1985) *A Passion for Excellence*; Pettigrew's (1985) *The Awakening Giant: continuity and change in ICI*; and Toffler's (1985) *The Adaptive Corporation*. Several key convergent concepts on managing change have emerged from such literature and these are discussed in the following sub-sections under five main topics:

- (1) Change and Excellence
- (2) Change is a Learning Process
- (3) Change and People
- (4) Change and Culture
- (5) Change and Leadership.

3.11.1 CHANGE AND EXCELLENCE

Organisational effectiveness and change management are inseparable. The hallmark of successful firms, as indicated by Kleiner & Corrigan (1989), is that their executive leadership is proactive in recognising the need for change as a necessity for survival and possesses the vision and courage to take required actions. Leatham (1989) shared a similar view when he said that the winners in tomorrow's marketplace will likely be those companies that learn to implement change quickly, with a minimum of internal disruption. McEwen et al. (1988) highlighted developing the competence, commitment and capacity for change (the three C's) of people as a vital element in the creation and maintenance of competitive advantage that should be an integral part of the strategic equations and business plans of any firm. The dependency of excellence on entrepreneurship or innovation is thus well accepted. As Carnall (1990) puts it,

"The present level of effectiveness of our organisation provides the context within which we wish to introduce change. The more effective the present organisation (in three areas -- effective team work, organisation structures and systems) the readier employees will be to accept change. Thus we are concerned with both effectiveness and change." (Carnall, 1990:10)

In their popular work *In Search of Excellence*, Peters and Waterman (1982) have identified a number of attributes that characterise excellent companies. Being innovative and therefore responsive to change is the major criterion for success. Reid et al. (1987) have extended these characteristics to effective schools. In short, these attributes include (1) commitment, (2) expectations, (3) action, (4) leadership, (5) focus, (6) climate, and (7) slack. (Reid et al., 1987:19). Basic to the line of thought of all these writers is the clear message that effective schools, like other organisations, excel because of their capacity for managing change and innovations on top of systems maintenance.

3.11.2 CHANGE IS A LEARNING PROCESS

Change and innovation in the packaged form is problematic. "The process is more important than the package", as Kleiner and Corrigan (1989) have said. Furthermore, change and innovation are learning processes (Beckhard & Harris, 1977; Fullan, 1982, 1991; Turrill, 1986; Kleiner & Corrigan, 1989; Carnall, 1990), and the effective organisation is the one that encourages and supports learning from change. Fullan (1982, 1991) sees 'learning' as the criterion for the implementation of change in schools. Teachers and staff who are committed to the change process are engaged in institutional learning and problem-solving. In terms of Peters and Austin's (1985) philosophy of visionary leadership, as Turrill (1986) has pointed out, such processes can only flourish in an entrepreneurial climate that legitimises experimentation, a climate where success is rewarded and people learn from their mistakes.

In his discussion about basic elements of the change process, Turrill (1986) maintained that purpose and vision, agreed and shared by people of the organisation, are needed to "pull the organisation forward". All that then remains, as he said,

"is to find the appropriate resources, to establish an organisational climate in which people learn from their inevitable mistakes, making plenty of them but never the same ones twice and to provide the necessary leadership to help people persist." (Turrill, 1986:18)

Turrill further indicated that a straightforward, linear and logical approach to change rarely works and he proposed an organic change process in its place with the following ingredients not necessarily executed in a sequential order:

- (a) Innovations (meaning experimental activities according to this writer)
- (b) Ice-breaking
- (c) Leadership, vision and strategy
- (d) Change vehicles, change drivers
- (e) Refreezing. (see Turrill, 1986:20 for more details)

"This approach involves the affected people at all times", as Turrill explained, "it builds on a number of small successes, rather than presenting major hurdles, which have to be jumped and which induce resistance" (Turrill, 1986:22). Likewise Fullan (1991:69) has indicated that early rewards and some tangible success are critical incentives during implementation of an innovation.

The experimental attitude advocated by Turrill in his organic change process described above is in line with the concept of the 'Six-A model' proposed in the thesis (see Section 7.6.3) for the CAA innovation, particularly for the assimilation phase. The need for change drivers to bring about successful changes is also vital in the CAA innovation although the writer is inclined to using the term 'change facilitator' instead (see Section 7.6.2 for explanation).

The process of change is basically a process of learning for the people involved. Taking this stance, Carnall (1990:189) distinguishes five stages in the process. He calls it the "coping cycle" - denial, defence, discarding, adaptation, internalisation. In addition, three effects need to be attended to in the coping cycle, which are the learning curve effect, the progress effect, and the self-esteem effect (Carnall, 1990:189).

Other writers have also reviewed much the same thing in the process of change. Tessler (1989), for example, distinguishes three stages of change as dissolution, passage, and renewal. During dissolution, attempts to transform things will be resisted and blocked as employees "mourn" the death of the old organisation.

Such actions are due to four basic human reactions to change according to Tessler (1989) - lack of identity, lack of involvement, lack of direction, and lack of affection. During the passage stage the individuals can catch their breath, complete a period of mourning and slowly begin to accept a new corporate direction. Renewal, the final stage of change, is a time for working together, moving in the same direction.

Along similar lines, Turrill (1986:52) has elaborated on the four classic phases of shock, defensive withdrawal, acknowledgement, and adaptation in a change process. People undergoing changes typically go through these four stages, though not always in a rational stepwise fashion and certainly at varying speeds. As Turrill explained,

"Change for the individual is basically a learning process. It often begins with feelings of dis-equilibrium, incompetence and discomfort. ... The effective change manager will, however, find ways to help and encourage them towards the positive outcomes of exploring alternatives, developing new behaviours, of adaptation, accommodation and individual growth." (Turrill, 1986:54)

Turrill was writing about managing change in the NHS (National Health Service), but much the same is applicable to schools. Reid et al. (1987), for instance, have referred to several commentators (the Schmucks, 1974; Cuban, 1984; Fullan, 1985; Purkey and Smith, 1985; Hopkins, 1986) and argued that because 'change is a process not an event', schools need to improve - and make more effective - not only their 'change process capacity', but also their understanding of the dynamics of change (Reid et al., 1987:12). The emphasis by these writers is that, in effective schools, the goal is effective implementation of innovations; it is the effecting of change.

The recognition of change as a learning process will help change-managers to break new grounds and to draw reference from other fields of knowledge such as learning theories. Dennison and Kink's (1990) learning cycle of 'do, review, learn, and apply' as a guide to experiential learning provides one such link. Joyce & Weil's (1986) approach of 'theory-demonstration-practice-feedback' provides another. Furthermore, however, the concept of change as a learning process invariably leads

one to focus on people in making changes. This crucial element is the third item in the current perspective of managing change and is the next topic for discussion.

3.11.3 CHANGE AND PEOPLE

There are many important works relating people as an essential to successful business strategy, such as Peters and Waterman (1982), Goldsmith and Clutterbuck (1984), Hendry and Pettigrew (1986). A concrete example of this idea put into practice is the series of 'People - The Key to Success' workshops run in June and July 1987 in a number of major U.K. cities. Over 200 chief executives, directors and senior managers in British Companies attended these workshops. These workshops were designed not as a 'one-off' but as the beginning of a process of change. Sponsors for the project were the Manpower Services Commission and National Economic Development Office (McEwen et al., 1988). The very title of these workshops indicated a shifting emphasis of successful management of current times - a recognition of the most valuable resource within an organisation, its people. The work of HR (human resource) departments and promotion of staff development activities are seen as vital in successful firms of today. According to Bolam (1982), considerable importance has been similarly accorded to in-service education and training of teachers (INSET) in British schools (See Section 3.12).

Achieving competitive success through people requires firms to do more than realise that people are an important resource for achieving competitive advantage. It requires also the development of the capacity for change and this is people dependent. In other words, if the basic premise is accepted that success depends on the capacity of change, and change is a learning process of the affected people, then proper attention to the human side of the organisation is the crux of effective management. A host of issues relating to the human nature in change thus follows from this line of thought. Resistance to change, psychological effects, self-esteem, stress and coping are on the list of commonly discussed topics.

Leatham (1989) has pointed out that it is disruption and psychological uncertainty that employees will resist, and not necessarily the change itself. The major problem in significant organisational change, according to this writer, "is not resistance itself, but rather the inability of the managers responsible for the change to anticipate it, understand its dynamics and respond effectively."

Gilbreath (1990) likewise has indicated that much misconception comes from the term resistance itself which suggests people deliberately trying to disrupt and damage. He comments quite rightly that defiance can be dealt with, but detachment and apathy present more serious problem in changes. In his suggested three "R's" to change, which includes 'refreshed' and being 'real' with a 'radioactive' vision, he goes to the extent to say that

"People love change. We like to be refreshed. 'Re' because change represents existing strengths, abilities, and pride; 'fresh' because we like what's new or different. Something old and something new. Add these to your vision." (Gilbreath, 1990).

The key to successful changes is thus not trying to fight resistance and win, but to replace resistance as Gilbreath suggested. By building certainty with information, fear of the unknown on the part of affected people is replaced by confidence and support for the change.

It is accepted that change is often a period of stress for the people involved (Turrill, 1986; Cooper, 1987; Kuhlmann, 1988; Carnall, 1990). Successful change managers therefore need to help the affected people handle these stresses with steps to improve their capacity to respond to change in a positive way. Two activities, as suggested by Turrill (1986) to be congruent with probable future paradigms, are to provide counselling support and encourage individual self-awareness or development programmes.

One further point that needs emphasis about the 'people' aspect in managing change is the phenomenological approach, or action frame of reference (Silverman, 1970). Though not using such terminologies, Kuhlmann (1988) puts it clearly as follows:

"The role of subjective factors is emphasised in both field of research findings about new-product adoption and human stress in change. It matters little whether or not an innovation facilitates the employee's needs and aspirations from an objective point of view; the way in which the employees experiences the innovation, his perceptions about what is happening, and the way in which it affects him will influence his response to the change." (Kuhlmann, 1988).

Negligence, if not ignorance, on the part of senior management about this key concept on people is perhaps why so many 'top-down' approaches in managing change fail.

3.11.4 CHANGE AND CULTURE

From the earlier sections on the 'classical' theories of change, two useful ideas are worth reiterating at this point. The first is Dalin's (1973) question 'for whom?' an innovation is good; and the second is the normative-re-educative strategy in change management. Recognising the importance of the people factor in the change process discussed in the previous section, the writer considers the success of any innovation to be directly dependent on how the participants themselves see the change as beneficial. This is the essence of the 'action approach subroutine' (AAS) used in the initiation phase as explained in Section 6.6.1. And because what people consider as beneficial is inherently dependent on their norms and beliefs, an understanding of the cultural factor in change is a necessity.

As an illustration, consider the cultural factor in Hong Kong schools in relation to the CAA innovation. It has been explained in Section 1.1 that Hong Kong schools are generally not innovative, and are not used to being involved in research. Irrespective of this, it has also been pointed out in that section that CAA is not in conflict with the culture of teachers, at least in Hong Kong, because the innovation has no direct impact on teaching methods nor curriculum. Teachers' autonomy within the classroom is not being threatened by the CAA innovation. The study has found this a fact for the case schools - that CAA is a welcoming innovation to teachers generally in Hong Kong (see Section 7.7.1).

Culture may be defined as the system of values, beliefs, myths, tools and practices through which we respond to our environment (Kleiner & Corrigan, 1989). Within an organisation, regardless of what it says in the employee handbooks and policy manuals, culture tells people what is permitted and what is taboo (Boyle, 1985).

The aspect of culture, in some sense, can be considered as an extension of the human element of change discussed in the previous sub-section. Since people live and work in organisations not as single individuals but as groups, teams, committees, or coalitions, their behaviours not only reflect the organisational culture but are constrained by it.

First and foremost, as Lorsch (1986) has pointed out, the culture of an organisation can create an invisible barrier to change. The reason is that "the culture of a company is like a prism through which its management views the world" (Kleiner & Corrigan, 1989) and a deeply held set of values and norms often produces a strategic myopia, meaning that members may miss the significance of external events and may be blinded by their strongly held beliefs. Furthermore, even if a need for change may be recognised, whether the kind of change or innovation introduced fits in with the culture will determine its fate. About this question of cultural consistency, Leatham (1989) also has remarked that "if there is a discrepancy between culture and change, culture will always win". According to Kleiner and Corrigan (1989), the executive leadership can therefore bring about the desired needed changes by understanding and shaping the values of the company. The controlling concept is that culture and strategy are tied together. An understanding of the role of culture is thus essential to successful implementation of major changes.

Handy (1984) has distinguished three different kinds of culture in organisations - role culture, task culture, and power culture.

Role culture, commonly known as bureaucracy, is characterised by stability, prescription, rules and standards according to Handy (1984). Positional power is a

predominant form of power in this culture. In a relatively stable environment, this can be a very efficient culture and is supportive of mission and success, and is to be nurtured and encouraged (Tunstall, 1986; Carnall, 1990). But in the face of change, such a culture may threaten adaptation and thus corporate success if not modified.

With task culture, people work together in teams to achieve certain objectives or tasks. As Handy (1984) puts it, leadership then is based on expertise rather than positional power. It is an adaptable culture in which the needs of the task, rather than systems and procedures, predominate (Carnall, 1990:113).

Organisations with a power culture, in Handy's term, are those which highly depend on one or more strong leaders. Direction and control are usually top-down and are largely dependent on personal, sometimes charismatic, influence. Whether or not an organisation with this culture can react well to change depends on the quality of its top people.

In the opinion of the writer, Handy's classification needs to be supplemented at least to include a fourth culture - 'development culture' - for innovative organisations. For effective and excellent schools, Reid, Hopkins, and Holly (1987) refer to what is called a 'development culture' under which teachers are supported in adopting and implementing desired changes effectively. Much the same point is made by Fullan (1991:134) in saying that collaboration in effective schools is linked with norms and opportunities for continuous improvement and career-long learning. This concept of the need for a development culture for successful schools is well summarised by Reid et al. (1987) by saying,

"The effective school effects change (i.e. develops) effectively. It establishes a development culture; it is ready for both change (and the learning through dissonance that goes with it) and the release of creative synergy." (Reid et al., 1987:16)

Irrespective of what the culture is in an organisation, it is only natural that any significant organisational change will meet with opposition or rejection in the first instance. "Neither logic, evidence nor the participation of all concerned appear to be enough," says Carnall, "new ideas can seem unorthodox and even risky. A manager

seeking support for new ideas must be sensitive to political processes." (Carnall, 1990: 118).

Culture and politics in an organisation are closely tied together. To manage effectively organisational changes, we need to understand the politics at work. This has become a widely accepted view - Pettigrew (1973, 1985); Pfeffer (1981); Lawler & Bachrach (1986) all supported this view. Furthermore, the works of Child (1984) and Hickson et al. (1986) developed the importance of politics within a contingency theory framework. Under the constraint or limit of contingent factors in the environment, managers have to make strategic choice among alternatives how to operate. And choice creates the conditions for politics because people with different interests will support various, perhaps conflicting, views regarding these choices.

Pettigrew (1985) argues that interest groups have different goals, timescales, values and problem-solving styles. Different interest groups have different rationalities. The thesis has found evidence in support of this where conflicts occurred between the office staff and teachers in the CAA innovation (see Sections 7.6.1 & 7.7.2). Change processes in organisations may be understood in part as the outcome of processes of competition between these rationalities expressed in terms of the priorities and values of the different interest parties. This distinction between the rational and the irrational is simple enough but it is argued that Weick's (1969) notion of 'multiple rationalities' is closer to reality for different subsystems in an organisation. Furthermore, the common approach to an organisation's political process by focusing on the so-called 'dominant coalition' should take note that coalitions are dynamic. The interests and concerns of people vary not only with respect to the kind of change introduced, but also changes over time for the same innovation. Membership of dominant coalitions therefore varies and leaders of change should be aware of such shifts. As Turrill (1986) has rightly pointed out, a number of the dilemmas of change have their roots in the need to reconcile the needs of the organisation and the individuals who work for it. The major task of change managers, especially during the initiation phase of the change process, is to attend to such dilemmas (see Section 6.6.1)

3.11.5 CHANGE AND LEADERSHIP

Leadership, particularly of the Principal, is vital for effective management of schools (e.g. HMI, 1977 and Reid et al. 1987). Support of the principal and senior management is definitely needed especially in the process of change. In all the cases studied in the thesis, lack of leadership or concern for success of the innovation inevitably led to failure of the whole (or a part like the school accounting module) innovation system (see Section 7.7.4).

Concepts of leadership and change would include such ideas as vision, sponsorship, and commitment. The role of the leader in change is well documented (Peters & Austin, 1985; Bennis & Nanus, 1985; Pettigrew, 1985). It is clear that without major and sustained commitment from the top of the organisation, change initiatives eventually flounder (Turrill, 1986:16). Changes should be "top-led" rather than "top-driven", according to Turrill. In much the same way, McEwen et al. (1988) have remarked that leadership is the linchpin in any significant changes. Without the exercise of positive leadership at chief executive and board level, effective change does not take place.

The dilemma of change, as pointed out by Turrill (1986), lies in how to achieve the necessary overall top direction whilst encouraging change at the grass roots. This needs expansion, though, for change in top management itself too is a prerequisite - a top-led change has to start from the top.

Change, when considered as the transition management (Beckhard & Harris, 1977) from the present to the desired state, is based on a vision. We have to have a picture of the present as well as a vision for the future end state. We need to know where we want to go before planning the route, as it is commonly said. Moreover, the vision needs to be holistic and not just partial. It has better to be shared rather than just contained in the head of the leader.

Vision not only gives a picture of what we are seeking to change but also an impetus. Carnall (1990) points out that

"the management of change is often a matter of the management of image. Create the image of success and it is surprising how quickly stereotyped attitudes can be changed." (Carnall, 1990:115)

Likewise Turrill (1986), writing about the National Health Service in the U.K., has indicated that leaders need to have a 'helicopter view' and that change requires a critical mass of visionary supporters if it is to become self sustaining. Tessler (1989) shares much the same thought by considering vision as the energising force that aligns people within an organisation and commits them to a common future because they can "see" what it is going to look like.

Having a shared vision is the starting point of the change process; and, to keep the ball rolling, sponsorship is required. Leathem (1989) interprets a sponsor as the person or group within the organisation who can legitimise the change, and he advocates the building of a network of cascading sponsorship - that each level of sponsorship should demonstrate a strong belief that the change needs to occur, and should be able and willing to commit the resources necessary for the project to succeed. Conner (1988) went even to the extreme to say that there is no such thing as "bottom-up change" because he was convinced that no sustained, substantive change occurs without effective sponsors who are senior-level managers with the organisational power to legitimise change and commit resources to implement it. His key to a successful change effort is simply this: identify a sponsor; get that person to sponsor the change; and maintain the sponsor's commitment throughout the change project. (Conner, 1988).

It is easy enough to say that senior management support or sponsorship is the key to successful changes. The kinds of support and the way they are delivered, however, depend much on the skills and styles of leadership.

As early as in 1978, Burns already distinguished two leadership behaviours - the transforming and transactional styles. The transforming leadership style has come to be regarded as crucial for management in the 1990's. Turrill (1986) argued that

change demands more of the transforming style, saying that transforming leaders (TL's) operate at a different level from transactional managers (TM's). TL's would engage totally with their followers, in such a way that both leader and followers are mutually empowered and motivated. And while TM's worry about the task and the people associated with the task, TL's are emotionally involved with the institution and its aims. Furthermore, TL's work with ideas, ideals and visions (Turrill, 1986:45). With a systems perspective, the essence of the transformational leadership style is that

"Transformational leaders derive their power from their followers and operate by empowering their followers. The process is symbiotic, the whole is greater than the sum of its parts" (Turrill, 1986:48).

This style of leadership aims to build and maintain a synergistic team among the subsystems involved in the change. Basically a number of change facilitating skills that are people-oriented is assumed, including skills such as co-ordinating, communicating, informing, questioning, listening, and training. Adam's (1987) list of five blocks in the process of change (perceptual blocks, emotional blocks, cultural blocks, environmental blocks, cognitive blocks) serves as a good illustration of the range of problem-solving skills involved. Adam has suggested various techniques for 'block-busting', which are mainly information collecting methods and application of thinking aids, such as synectics. All of these skills or techniques can be developed, but there is the pre-condition that the right attitude is there in the leadership. Carnall (1990) makes a point in saying,

"Sensitivity and empathy, along with involvement, openness and the rest, are the order of the day [for the leadership] in a period of change." (Carnall, 1990:190)

In their summary of what is known about effective schools, Reid et al. (1987:29) have listed ten attributes. The very first of these is that the leadership role of the principal and the senior management team is vital. Although these writers commented that there is little scientific evidence to support this frequently reported assertion, the importance of leadership is difficult to deny. In the *Ten Good Schools* (HMI, 1977), Her Majesty's Inspectors concluded essentially the same thing. It was pointed out that 'without exception the most important single factor in the success of

these schools is the quality of leadership at the head.' Such qualities listed by the HMI's include imagination and vision; realism; holistic view; specific educational aims; communication skills; sympathetic understanding with good humour; sense of proportion; dedication; and power-sharing. These are perhaps 'the rest' referred to by Carnall (quoted above) as the order of the day for the head in a period of change.

3.12 WHOLE SCHOOL APPROACH IN EDUCATIONAL CHANGE

Writing about professional development and school improvement, Bolam (1982) says that "The 1970s saw the creation of a climate of professional opinion in which the in-service education and training of teachers was accorded considerable importance" (Bolam (ed.), 1982:216). This reflects the emphasis that is rightly put by educators in the U.K. on staff development to achieve school improvement. In line with the current perspectives of managing change explained in the previous section, school effectiveness has to be tied closely with developing the people and with school innovations.

Not many educators in Hong Kong have recognised yet the important linkage between INSET and educational innovations. Although many programmes are run locally for teachers under the term INSET by the Education Department and the universities, these are merely refresher courses in the traditional sense. With a centre-periphery approach, the essence of school-focused INSET for professional development is still missing in Hong Kong. In this regard, Bolam's (1982) elaboration using Hoyle's (1973) four propositions for INSET and curriculum development should ring a bell clearly for local educators:

- (1) that more INSET should be linked with specific school innovations;
 - (2) that more INSET should focus on functioning groups (e.g. a departmental team, the heads of department or a whole staff;
 - (3) that schools should establish their own staff development programmes;
 - (4) that schools should receive support, including consultancy, for their staff development programmes from local professional centres.
- (Hoyle, 1973; in Bolam (ed.), 1982:216)

An underlying approach to educational change seems to be evolving. This regards teachers both as the target for development, and as the most effective vehicle for improving the educational process within their schools. Bolam's (1976) review of educational thinking and practice in OECD member countries concluded that

"Whatever their traditional approach to innovation, a number of member countries are beginning to recognise weaknesses in the centre-periphery or top-down models, and they are becoming increasingly concerned with the problems of the user (i.e., teachers and schools)." (Bolam, 1976)

In parallel with this trend towards a people-oriented approach in improving schools is the major concept of attending to the whole staff - the whole school approach for innovative schools. Other metaphors instead of innovative would include 'creative', 'problem-solving', 'thinking', 'healthy', or 'self-renewing'; but all of these have a bearing on the school's ability to managing innovations. In explaining this concept, Bolam (1982) used Nisbet's (1974) definition of creativity as the school's capacity to "adopt, adapt, generate or reject innovations". Furthermore, the same writer explained the features of the problem-solving schools with reference to the influential Rand Studies in the U.S.A.:

The problem-solving that characterizes the initiation of change for the ideal adaptive school system has three main elements:

- (a) The response to external pressures for change is proactive in the sense that it typically anticipates external demands and prepares a local solution before 'exogenous shocks' become local crises.
- (b) Internal demand for change is continually stimulated and considered as legitimate. Needs are assessed and problems are identified on an on-going basis.
- (c) The formulation of proposals in response either to external pressures or indigenous demands and needs consists of a process of mobilizing political as well as organisational resources. The crucial ingredient of this process is that staff of all levels participate in the proposal. By so doing, they can develop a sense of ownership in and commitment to the specific planned changes, and, more importantly in the long run, a sense of trust in the organisation's willingness to change. (McLaughlin, 1976; in Bolam (ed.), 1982:219)

It should be clear from what has been discussed that an innovative or creative school builds heavily on the whole school approach. Furthermore, Bolam (1982) has suggested that both concepts of the whole school problem-solving approach and its related people-oriented techniques can borrow much from the use of some available technical resources and methods under the umbrella term 'Organisational Development' (OD). Everard & Morris (1985) hold a similar view, saying that "The main thrust in increasing managers' capacity to manage change has come from a set of behavioral science theories and approaches called 'organisation <al> development', usually abbreviated to 'OD'. The Schmucks (1977) and Fullan et al. (1980) are proponents of it in the context of education" (Everard & Morris, 1985:165).

In the following paragraphs the basic concepts and approaches of OD are reviewed, with an attempt to see what might be of relevance to the management of change in educational institutions.

One concise definition of organisational development (OD) is

"... an effort (1) planned, (2) organization-wide, and (3) managed from the top, to (4) increase organization effectiveness and health through (5) planned interventions in the organization's 'processes', using behavioral-science knowledge" (Beckhard, 1969:9).

OD takes a process approach rather than a task approach in changing the behaviour of the 'people' subsystem within an organisation. As Warren describes it,

"Organizational development, as a process, represents a recognition and implementation of the importance of looking at change holistically, considering not only its behavioral but also its relational and ideational components, and not only in its utilitarian aspects but also in its appreciative or expressive aspects." (Warren, 1977:179)

Warren (1977) also indicates that ambiguity and flexibility surrounding the term OD are simply the signs of a new field of interest and activity whose focus and perimeter have not yet been defined. This writer explains that the term OD relates to those methods that 1) engage the total organization or major part thereof, and 2) deal with behaviour, relationships, and ideas in both their utilitarian and appreciative

aspects. The term OD is used to refer to efforts that emphasize a state of development rather than a single, one-time event (Warren, 1977:180).

The basic strategy in OD approach is the use of the T-group, including training group, laboratory training group, and sensitivity group, and Warren (1977) has identified six common elements which characterizes it. Although T-groups are at the core of most OD approaches, they are supplemented by a variety of methods: data feedback from surveys and other sources, confrontation meetings, action research, group therapy, training group leaders, reorganising formal and informal communication channels, managerial grid seminars, and team development. For instance, Blake, Mouton, Barnes, and Greiner (1964) have presented their Grid Organization Development (Grid OD) Program as an example of breakthroughs in organisational development.

Organisational development as applied to schools, according to Schmuck (1974),

"involves staff members themselves in the assessment, diagnosis and transformation of their own school. Rather than simply accepting diagnosis and prescriptions from an outside 'technocratic' expert, organisation members themselves, with the aid of OD consultants, examine current difficulties and their causes and participate actively in the formulation of goals, the development of new group process skills, the re-design of structures and procedures for achieving the goals, the alteration of the working climate of the school and the assessment of results." (see Bolam (ed.), 1982:222 for details).

The use of organisational development approach in educational institutions is not yet widespread in U.K. and in Hong Kong. In the United Kingdom, Bolam (1982) remarks that experience indicates that many teachers are likely to find OD unacceptable because of its unfamiliar and potentially threatening nature. Teachers are far more likely to be attracted to task consultancy, rather than process consultancy as in OD, because they believe their problems to be mainly of a curricular or organisational kind. As Bolam describes it,

"Arguably a consultancy team might take such task definitions as its starting-point and gradually open up the possibility of using process consultancy, including OD. However, we have a long way to go before we reach that point." (Bolam, 1982:224)

Much the same applies in the Hong Kong situation in the use of OD in educational institutions as in the U.K., and possibly more difficult. Because of the cultural background of the oriental people, who are less open and more conservative comparatively, T-groups in educational institutions will be really difficult innovations.

Other than the reasons given by Bolam, one other major cause why OD is not well accepted by schools is due to the wrong emphasis put on its approaches, instead of on its underlying philosophy. The essence of OD is not necessarily bringing in behavioral science techniques like T-groups, but rather, as described by Warren:

"What gives organizational development its special nature is its holistic approach to the total organization or major division thereof, and its emphasis on creating a climate of trust in which feelings can be expressed and other kinds of feedback can be given as well. While these objectives are instrumental in bringing about change (through unfreezing the situation and opening the decision-making process, and the like) they are also important as the end products of that change, in that such openness, trust, and free communication and participation in decision making will become a part of the new level of stabilization." (Warren, 1977:184)

In an article contrasting organisational development and management development, Burke and Schmidt (1971) have also summarised that OD is a strategy "to change the organization's culture from one of dealing with problems 'as we have always done' to a culture that takes full advantage of the human resources the organization has available, and allows for a process to develop which will ensure that the organization can plan and implement needed change at all levels rather than having to adjust to change that is already in process." In the writer's view, it is this core concept of OD which educational institutions should adopt, not the peripheral strategies of using T-groups, sensitivity trainings, or confrontation meetings which have masked the spirit of OD.

In summary of the discussion of the current perspectives of managing change, emphasis on holism, on process, on people, on culture, on learning and development are the key elements to be recognised by educational leaders for successful changes. Furthermore, a school does not achieve a status of being 'problem-solving', or 'effective' , or has accomplished 'OD' by any single change process or series of events. The school, as a system, has to learn and cultivate a 'development culture' (see Section 3.11.4) by engaging itself continually in various educational innovations - each to be managed with the spirit discussed. CAA for instance, which is the focus of this study, is considered as one such innovating activity in the school. Only through such cumulation of experience can the people in the school attain the attitude of learning by innovating, so that the school as a whole can become increasingly effective as a result. Only then will external consultancy advocated in OD become welcoming by teachers as a support, rather than resisted as a kind of intervention or intrusion.

CHAPTER 4

COMPUTERS IN EDUCATIONAL ADMINISTRATION - TECHNICAL KNOWLEDGE

4.0 INTRODUCTION

In the previous two chapters, literature about systems and management of change have been examined. These are considered as general knowledge fundamental to the management of educational innovations in general. There is, however, still a gap to be filled before such knowledge can be utilised to carry out a school innovation with success. This gap is the technical knowledge and skill required specific to CAA - the 'innovation system' (see Section 6.5.2 for a detail explanation of this term). In other words, knowledge and skill have to be sought by the writer regarding the use of microcomputers, particularly in the areas of school administrative applications and the approaches to software system design.

The history of CAA at the school level is not long. The reason is that microcomputer technology that began in the late 1970's became popular at affordable prices for schools only in the 1980's. In fact the development of IT (Information Technology) and capabilities of microcomputers since 1985 when this research began has been surprisingly rapid. Microcomputers with memory and storage in units of megabytes, multi-tasking, multi-user networking, tele-communication, as well as RDBM (Relational Database Management) or 4th generation QL (Query Languages) are common terms nowadays unheard of in the mid-1980's.

In this chapter the significance of information management is first discussed, linking to the possible objectives of the CAA innovation in education. The histories of CAA in the U.S.A., the U.K., and in Hong Kong are then examined. These contribute in part as background understanding of CAA to the writer, and are illuminative especially in the areas of CAA applications as well as in CAA approaches. The chapter ends with a section on the current and future scenario of CAA.

4.1 THE INFORMATION AGE

In the year 1822, the Astronomical Society in Britain published Charles Babbage's first paper describing the model of his 'Difference Engine'. That started the history of computers, to be followed by a day around 1950, when the first electronic computer came to life. The acceleration of technological development since then is unprecedented and computers or word processors are common in schools and homes in the nineties.

The significance of information as an integral part of an organisation, especially in a successful one, hardly needs much elaboration. Leavitt, Dill, & Eyring, in discussing information and control, say that organisations do indeed live to do things -- to make products, to provide services, to satisfy clients in one way or another and that they draw their nourishment from information. It is information and the flow of it in an organisation that binds it together into a single, coherent unit (Leavitt, Dill, & Eyring, 1973:57). Bate & Burgess make a similar point in saying,

"Information contained in offices is not only vital to individuals but is also a crucial part of any organisation. An organisation needs information just as an engine needs petrol." (Bate & Burgess, 1985:2).

As society is changing at an ever increasing rate, an organisation's environment becomes more uncertain. With more uncertainty an organisation will have to process more information (Galbraith, 1973: 5). Only those organisations that can keep pace and know how to use information with the rapid change of technology will survive, and the ones that have better control of relevant information will gain advantage in this competitive world.

Alongside the recognition of the importance of information to an organisation is the increasing emphasis put on the administration office, and rightly so because that is where information is being handled most of the time. Thus 'office technology' or 'office automation' are common terms in the business sector which mean in essence the incorporation of technology in the betterment of information processing. For example, Bate & Burgess (1985) consider that the main thrust of office automation

is connected with electronic information processing. Furthermore the office can become the information centre of any organisation, serving as a means to an end instead of just an executive agency. Similarly, the strategic position of the office in an organisation is clearly identified by Hirschheim when he says: "There is a growing awareness that information is an integral part of the production of goods and the provision of services. Take away a company's database and it will not be able to operate effectively. The role of the office should ensure that the right information is available, in the right form, at the right time, in the right place to support the decision-making process" (Hirschheim, 1985:22). Added to this, it must be said, should be the dissemination of such information to the right person/persons, a point that is often overlooked.

Information is needed in any organisation in activities such as planning, maintaining records, direction, operation, evaluation, and control. The terms data and information are often used interchangeably but actually they have different meanings and it is necessary to distinguish between them. The difference between data and information has been recognised even early as in the 1960s. For instance, McDonough & Garrett (1967) considered data only as potential information. Data is something that is transmitted to the relevant people who then interpret it as information. Schoderbeck (1968) went further to add that information concerns with selected data -- data selected with respect to problem, user, time, place, and function. It is true that different people within an organisation will need different kinds of information according to their job and depending on the kind of task they have on hand. Furthermore, and most importantly, how a user interprets the data critically determines the kind of information produced.

4.2 BENEFITS OF COMPUTERISATION

The computer is an indispensable item in modern office technology. Any organisation going for office automation or computerisation has two simple aims: increased benefits, reduction of costs. Parkin (1980) defines these variables in very simple and general terms:

Benefits -- things that the sponsor [organisation] desires;

Costs -- things that the sponsor [organisation] wishes to avoid.

To supplement Parkin's view, it may be appropriate to consider both efficiency and effectiveness as crucial elements of benefits to be gained. Much has been written on office automation and its associated benefits for the business sector. Bate and Burgess (1985) classify them simply into three main areas: increased productivity, lower costs, and improved facilities. In more details Abraham (1981) identifies five areas about the potential benefits of office automation. Each of these areas is discussed in the following with specific reference to the case of CAA in schools.

Area (1): Better utilization of human resources, either by reducing the number of employees or by having the same number perform more work.

The writer well agrees with the better utilisation of human resources with CAA but has reservation of putting reduction of the number of employees as an objective. Although in the case school studied in Hong Kong, CAA was used as a solution to resolve the problem of staff reduction because of some other reason (see Section 7.7.1), the benefits of CAA are more related to having the same staff perform better work (e.g. better quality with word processing).

Area (2): Increased performance -- through the increased output per person.

In the opinion of the writer, increased output per person may be achieved only when the CAA innovation has become institutionalised. During the transitional process of change, extra resources of effort and time have to be put in as a matter of fact and output may be temporarily decreased.

Area (3): Increased quality of decisions, work, products and services -- through improvements in handling information.

This is undoubtedly the most important objective of CAA. Lancaster (1989) distinguishes the level of CAA application into 'Administrative Systems' and 'Management Information Systems'. The ideal of CAA should rest not only with assisting routine administrative tasks, but with supporting for better quality of decision making and forward planning (see also Section 4.5).

Area (4): Increased efficiency -- through the performance of tasks in less time.

This is one of the prime objectives of CAA in the long run. Using the computer, a number of clerical routine jobs like mark calculation and report writing can be released from teachers. Time saved on the part of teachers can thus be devoted to more educational and professional work. Concentrating on the tangible benefit of time-saving alone in enhancing management productivity, Uhlig, Farber and Bair (1979) have shown how office automation led to a saving of over 2 hours in an 8-hour working day. In the thesis, one case school estimated that at least two hundred man-hours per year could be saved for the form-teachers alone (see Section 7.7.1).

Area (5): Increased effectiveness -- through improved organizational communication.

While recognising that improved organizational communication is one factor contributing to increased effectiveness, it is argued here that effectiveness is more related to the increased quality of decision making discussed in area (3) previously. According to the finding in the thesis (see Section 7.7.3), no significant structural change is identified with CAA at the 'Administrative Systems' level (Lancaster, 1989). The situation will be different though with the facilities of computer networking and telecommunication. Internally a school with a network of computers can improve communication among its different departments (e.g. between the counselling and academic

departments). And with telecommunication capability, its external communication (with the central education office or other agencies) can also be enhanced. In both cases, the writer is of the view that modifications of the existing system of communication are needed in support of such objectives. In other words, without adaptations of the other three subsystems of task, structure, and people within the organisation, a change in technology alone cannot bring about the desired effects. This is an important concept in change management discussed in Section 6.5.3.

The previous discussion based on Abraham's (1981) classification demonstrates that the potential benefits of office automation apply not only to the business sector, but also have relevance for CAA in schools. These objectives for computerisation are supported by many other writers. For instance, an alternative view of considering all people working in an office as a whole instead of focusing on management alone led Price (1979) to the identification of four potential benefits from office automation which Lodahl (1980) calls the "value-added" ones:

1. Increased information accessibility -- An information management system (IMS) can provide information which is more up to date and accurate, and can also search, define requirements and retrieve relevant information quickly and cheaply.
2. Increased accessibility of people -- Electronic message systems can provide the possibility of non-simultaneous contacts (e.g. store and forward). It will permit people to communicate efficiently even though both parties are not at the same place or are not simultaneously available.

3. Increased control over personal activities -- this is realised through the possibility of working from different locations, for example by using intelligent terminals (which may be housed inside a briefcase). Electronic message systems will enable individuals to control when they wish to look at messages rather than having to endure constant telephone interruption while trying to concentrate.
4. Increased individual contribution -- individuals can spend more time on their primary tasks, rather than auxiliary support tasks.

Much the same holds true for the administrative use of computers in education as in business. It is interesting to note that the same issues, identified already seventeen years ago for MIS in education, are still as important these days. To quote from that LAMSAC (1974) report titled "Towards a Computer Based Education Management Information System", the following benefits that computerisation can offer to an education service were concluded:

1. Better Quality of Information -- since the computer will reject input data not to system requirements users are obliged to adopt standard procedures, rationalized documents and consistent codes, which make the accuracy and reliability of information more assured - a real benefit regardless of whether a computer is to be used or not.
2. Saving of Time & Effort -- the computer offers the facility for saving clerical effort by taking on routine, often mundane tasks which are performed at the moment by human beings.
3. Improved Decision-making -- once the records have been established on the computer and are being efficiently maintained, there is endless scope for analyzing data, which is not possible under manual methods.

4. Better Communication -- computers can be used to transfer information in standardized formats from one point to other without incurring a lot of clerical effort. This would facilitate the easy transfer of statistical information in the education service.
5. Better Control & Allocation of Resources -- the computer offers the possibility of bringing control to areas formerly inadequately controlled because of the cost of setting up manual systems to do so. (LAMSAC, 1974, sub-headings added)

Every educational institution, district, or state possesses some kind of information system, be it manual or computerised, formal and/or informal. But whether the information system is effective or not is another question. Even early as in the mid-1960's, Grossman (1964) recognised already the ideal that an effective school information system should facilitate the decision-making process by providing responsible school personnel with a means of optimising the goals of a total school district. It should also allow the able administrator to discern patterns which will enable him/her both to view the district concerned as a whole and to identify readily those areas requiring his/her immediate attention. These goals are still valid in the 1990's and fit in with the current perspective for CAA (Section 4.5). Lancaster's (1989) advocacy in the U.K. for 'Management Information Systems' on top of 'Administrative Systems', just like 'Decision Support Systems' proposed by Fisher et al. (1990) in the U.S.A., are illustrative examples of such aims in common.

One other point from Grossman's (1964) discussion is worth noting. This is the issue of continuity in the use of CAA. From the creation of what Grossman called 'true education intelligence', he commented that

"... the creation of true education intelligence: in contrast to human intelligence, which comes and goes with the individual, education intelligence, compactly filed away in electronic memories and readily available, can stay with the school district and provide continuity as long as the district exists." (Grossman, 1964)

Provision of continuity is emphasised because of its vitality to any organisation or in fact, to any system. Grossman is one of the few early writers who has pointed out its relevance in discussing about educational information processing systems.

Supporters for office automation have thus advocated quite a number of predicted or potential benefits for incorporating the modern technology in both the business and the education sectors. They realise, though, that actual benefits or increase in productivity do not necessarily follow by the very act of automation. Much depend on the way in which such technology is imported into the organisation. Hirschheim says, for instance,

"In a number of quarters it is increasingly being recognised that the application of office technology is less a technical innovation than a social one, with the social risks involved being potentially very great. Therefore, the handling of the implementation of new technology is crucial in minimising the potentially deleterious social consequences. Additionally, implementation should somehow ensure that the new technology meets user requirements and gains user acceptance; a fact which history has shown us is neither easily done nor well understood." (Hirschheim, 1985:viii)

In summary, automation or computerisation in an organisation aims at becoming more effective with higher efficiency. "Effective" is taken in the sense that the organisation has a higher probability of achieving its objectives with a better system of ensuring success, and is therefore goal-oriented. "Efficiency", on the other hand, is both objective-oriented and process-oriented. The classical definition of efficiency as the ratio of output to input ($\text{Efficiency} = \text{Output/Input}$) encompasses very neatly the concept of benefits and costs. In the practical world, what one can input into a system is often a matter of priority, and the challenge to any administrator in an organisation has always been the question of how to achieve goals with maximum efficiency.

4.3 COMPUTERS IN SCHOOL ADMINISTRATION - A SHORT HISTORY

Computers were expensive machines in their early days of development and thus were affordable in the educational sector only for some universities and colleges initially, this being the natural case in the United States of America, the United Kingdom, as well as in Hong Kong.

It is appropriate to borrow at this point, from Berg & Bramble (1983), the division of three phases of development in educational computing in the U.S.A. These writers consider that the process of transformation began in the early 1960's with an 'Experimental Phase' when attention was focused on the potential of the computer as an educational device, but cost and inaccessibility prevented widespread adoption.

The second phase of educational computing, which Berg & Bramble (1983) call the 'Popularization Phase', began about 1977, when powerful but inexpensive microcomputers were introduced. It is difficult to predict when the Popularization Phase will end. The transition to the next phase is situational. Some school systems are already moving into the third phase of educational computing. Other systems are only now beginning to enter the Popularization Phase.

As projected by Berg & Bramble (1983), the third phase of educational computing, the 'Transition Phase', should begin in the mid-1980's and extend to the turn of the century. This has in fact happened and is extending into the 1990's. The Transition Phase is a time when educators have an opportunity to use technology to fundamentally improve, and in some ways transform, public education. Both policies of LMS (1998) in the U.K. and SMI (1991) in Hong Kong are heading in such a direction.

The developmental model of Berg & Bramble (1983) discussed was referring to educational computing as a whole in the U.S.A., but it certainly has special relevance in the case of CAA in the writer's view. In the case of Hong Kong, the

period between the late 1970's and mid-1980's can be described as the experimental phase for CAA. This was followed by the popularisation phase until now when about 85% of secondary schools use some form of CAA (see Section 4.3.3). The transition phase may be forth-coming with the recently introduced SMI (1991) in Hong Kong.

A somewhat different framework recently used specifically in the study of CAA in seven countries (Visscher et al., 1991) applies a developmental model with four stages: initiation stage, expansion stage, integration stage, and stabilisation stage. Although different in terminology, the developmental phases are essentially similar.

In the following sections 4.3.1 to 4.3.3, a review of the CAA situation in the U.S.A., in the United Kingdom, and in Hong Kong up to and including the period of this study are presented. It should be borne in mind, however, that this study began in 1985 when CAA with microcomputers was just in the embryonic stage, current situation at the time of writing has changed significantly and Section 4.5 on the current and future scenario will give an updated view.

4.3.1 The U.S.A. Scenario

Schools in America did not lag much behind their counterparts in higher education in adopting computers both in management and in teaching. Many educationalists in the 1960's were already concerned with different aspects of computer applications in schools. Discussion about using mainframe computers in school management as well as school district administrative applications can be found in the early 1960's. In the foreword to a workshop titled "The Automation of School Information Systems", John Caffrey, President (1963-1964) of the AEDS (Association for Educational Data Systems), described the scene of his time in the U.S.A. as follows:

"Since 1960, educational data processing has generated more interest and attention than in any previous period. We have witnessed the founding of an Educational Data Processing Newsletter, the establishment of associations in such states as California, Colorado, Texas, and Florida, the sudden birth of and phenomenal growth of the AEDS, and the initiation of a series of monographs by the newly

founded Educational Data Systems Corporation. The Project on Information Processing, with headquarters at Montclair (New Jersey) State College, assisted by unrestricted grants from a major manufacturer, is now publishing a newsletter and stimulating or producing other materials related to careers in automatic data processing. Summer workshops have been offered by a handful of private and public universities, and there are even a few regular courses designed to acquaint educators with relevant data processing methods and systems. National Defense Education Act (NDEA) funds have stimulated much healthy growth at state and local levels." (John Caffrey, 1964)

The interests shown in the automation of school information systems were established on similar grounds as those in the commercial field. The significance of information in a school organisation was recognised by many people. Wagner (1964:23) pointed out that administrators in business, government, the military, and schools can make effective decisions only when supplied with adequate 'intelligence', i.e., information that must be analytical in nature and broad in scope. This requires the collection and integration of much data, speed of processing, and accuracy. The technology of data processing using the computer can meet these requirements most successfully.

Wagner has also analyzed the need for information to enhance decision making at three different levels within the school system: (1) the superintendent's level; (2) the principal's level; and (3) the teachers' level. Each level has its own peculiar demands of educational "intelligence". The superintendent's level involves essentially policy decisions; the principal's level is primarily one of instrumenting policy; while the teacher's level is one of providing the motivation and opportunity for learning by the students. Wagner did not neglect to mention, though, that all school activity is solely for the purpose of educating the young people of the community more efficiently.

A number of people thus have shared for long the common view that an effective school information system facilitates decision-making processes by providing responsible school personnel with a means of optimising the goals of a total school district, and that an effective electronic data processing system affords educators a

means for developing, to the fullest extent, the vast reservoir of human resources (Grossman, 1964; Bicknell, 1964; Bushnell, 1964). However, there was not much development in practice on CAA for schools in the U.S.A. during the 1960's and 1970's.

One of the first tasks to which computers were applied in the educational setting of U.S.A. was in timetabling or scheduling. A number of universities and colleges were attracted to this for two reasons:

1. The aim of using the computer as a management device directed towards the improvement in a student's choice of course and the over-all utilization of resources;
2. The very nature of scheduling problems is an object of mathematical research by itself.

Purdue University, for example, purchased a computer in 1956 and began work in earnest on a computer system for registering, scheduling, and assessing fees for all students (Blakesley, 1964). The development of the project was divided into two parts: Part I - The Scheduling of Students to a Predetermined Schedule of Classes, and Part II - The Construction of an "Optimum" Schedule of Classes. Schure (1968) pointed out that scheduling has proved an excellent introductory vehicle to orient school administrators to potentials possessed by computers to implement an instructional program meaningfully. The argument was that the computer could handle the multitude of variables masking efficient utilisation of the school's fundamental resources of students, teaching staff, available times and spaces. It could be used effectively to translate scheduling strategy to meet an individual student requirement in an optimised manner. Thus the scheduling service would be best for introducing users - administration, teachers, and students - to some, albeit conventional, potentials of the computer.

Irrespective of the keen interest shown by some educationalists and associations like the AEDS, it took almost a decade before some schools in the U.S.A. really took part in the scene. By 1968, a number of organisations were

seeking, through application of modern computer technologies, to raise the low levels of school data-processing to the significantly higher levels of sophistication represented in data-processing within the business and industrial spheres. They sought to develop, in private and public education, those quality-control techniques which could result in optimized, logical, effective decision-making within the educational process (Schure, 1968). The approach then was all linked to a culture of 'scientific management' prevailing at that time when quantitative controlling systems like PPBS (Programme Planning Budgeting System) or PERT (Programme Evaluation Review Technique) were popular in the United States. This differs significantly from the current views which recognise, for instance, individual school autonomy and human factors like coalitions or bargains within an organisation (see Section 3.11).

At the early stages of computer aided administration, the computer "outputs", which formed the major portion of the services, usually included: (1) creation and maintenance of major files containing standard information about students; (2) attendance accounting to yield automatic preparation of school's attendance register as well as individual student attendance files; (3) test scoring and analysis oriented to a school's particular information requirements and guidance practices; (4) grade or mark reporting, recording, and analysis; and (5) scheduling.

The use of the computer as a management device was not limited within the boundary of any one single school. Feasibility studies of using a large-scale time-sharing system to serve a whole school district in America had been conducted. Lewis (1968) and his associates, for instance, worked on a feasibility of using central computer facilities to supply computational and data-processing needs to 50 institutions with a student population of 100,000. Part of the study included visits to schools and to the NEEDS network and the Iowa Educational Information Center which were already then providing centralised data-processing services for a number of schools. This type of centralised service was found to be well accepted by the administrators of the member schools. That did not mean there were no problems with it, and factors both opposing and in support of the feasibility of such a system were identified by the Lewis group.

In conclusion to his report, Lewis (1968) commented that the factors which opposed feasibility would all tend to diminish with time, and the factors which supported it would tend to expand. Thus, although the system studied was found not feasible then, it would almost certainly be feasible at a future time.

Interestingly, however, a similar study by an IBM project group led by Stone (1968) which extended over the period from May 1 to September 8, 1967, came to a positive recommendation in contrast to Lewis' study. Under a contract commissioned by the U.S. Office of Education, the Stone's group established the feasibility of a large-scale time-sharing system to service 500,000 school users within a geographic region defined with an average radius of 100 miles. Both technical feasibility and economical feasibility were considered. As to the first feasibility, Stone was sure that his group members all agreed that the remote-terminal time-sharing technology was well established. Economic feasibility was the crucial issue. After considerable study, they concluded that it was quite reasonable to meet the administrative need of kindergarten through grade twelve and the instructional needs of grades nine through fourteen with a reasonable level of service, using a single central processor with multiple remote typewriter terminals. The single recommendation to the Office of Education was to get on with the program.

Services provided by regional computer centers to educational districts in the different states of America has been the case for the past two decades. For instance, the New York State School Computer Services System (NYSSCSS, 1984) delivers substantial student management and financial management services to 618 out of 729 (84.7%) districts in New York State as at 1984. These districts represent over 1.5 million students.

In view of modern technology and advancement of microcomputer development, as the NYSSCSS put it, such a centralised provision of educational computer services has been found to be unsatisfactory and is not without problems. An overview of its present situation performed by the NYSSCSS in 1984 identified twenty-two problems/needs including: staff problems, training problems, management

problems, inflexibility to changes, lack of integration between software systems, and incapability of meeting end-user demands. In the writer's opinion, all these problems arose partly if not all as a result of a mechanistic top-down approach in management. The central education administration office in New York, similar to that in Hong Kong, probably has an executive function at the fore-front. Without a phenomenological perspective in mind, as emphasised in this thesis, school initiatives were neglected and no user participation was incorporated. In consequence, "such a centralised provision of educational computer services has been found to be unsatisfactory and is not without problem" (as stated above) is due more to the problem of change management than to advancement of modern technology.

On the technical side of providing computer services to school districts in the New York State, the modes of delivering computer capability were changing. According to the paper "Future Directions For The Delivery Of Computer-Based Management Services To School Districts In New York State", which was co-operatively developed by the District Superintendents of Schools in June 1984, the long in practice mode of batch processing (where data were transported to a regional computer center mainframe; processing took place and reports were returned manually to school districts) would be replaced. Their next phase in the evolution of service delivery was the on-line terminal approach. In this approach school districts had terminals and in some cases printers. Using the terminal they entered data and made requests. Processing took place at a central mainframe, and screen or reports were then transmitted to them through a telecommunication link. Their third model that appeared most viable, both technologically and in terms of meeting the service needs of school districts, involved the use of on-site computers in conjunction with larger systems and integrated databases. Within this model a large number of computers were linked in a basic network which included a mainframe located in the regional center and smaller processors within school districts.

The concept of distributed data-processing with on-site computers for the end-users was therefore the trend. Such decentralisation is usefully stated in a State Education Department/State Legislature of New York:

"A well designed information system with an integrated, standardized core of data relevant to the needs of school districts would also serve the majority of state level information needs. Restated, with the right system, state information needs could be met as a by-product of local district computer based systems." (NYSSCSS, 1984)

Even in the third model of the NYSSCSS which is technically feasible, there is still a lack of comprehensiveness in attending only to the needs of the state and districts, leaving out schools from the system. In the writer's opinion, this is the problem of not having a holistic systems view.

4.3.2 The British Scenario

In England, the first entry of a computer into a school -- The Royal Liberty School -- was marked by the following headline in the Times Educational Supplement June 24, 1966: "Lord Robbins pressed the button ... With as simple a gesture as that the first computer to be bought and run by a school in England was set in motion". Initiated by an enthusiastic mathematics teacher Broderick, the computer was finally put into action at his school after more than three years of planning and appealing for the needed funds. Although the computer was purchased only for teaching programming and mathematical ideas, Broderick made quite a far-sighted assessment of the part that the computer was likely to play in education in Britain in the years ahead of him. It is interesting to see the relevance as to date of what he wrote about using computers in school administration:

"

A School Data-Processing System

... Educational considerations are relevant; for the best way to learn about the application of computers to data-processing problems is actually to use a computer for this purpose -- and what could be more appropriate than real live problems from within the school? Clearly, the development of a data-processing system for any particular school will vary with the peculiar characteristics and requirements of that school; however, here are some possible subjects for a school data-processing system:

1. Student record-keeping
 2. Report printing
 3. Capitation Control
 4. Stock Control
 5. Other statistical work for internal and L.E.A. purposes."
- (Broderick, 1968:90)

Broderick further added, in connection with school timetabling, that "The construction of a school time-table is no small problem: for a three-stream Grammar School it can require up to a hundred man-hours, usually on the part of the headmaster, deputy headmaster or the senior mathematics teachers, i.e. from one of the most highly qualified and valuable members of the school's staff. Could not this work be done by a computer?"

Broderick was definitely ahead of his time and his vision is realised only twenty years later in the 1990's. Perhaps it was true, at Broderick's time in Britain, that the application of computer techniques in school administration was difficult to justify on purely economic grounds. Broderick was well aware of this when he tried to draw the attention of his country to the future demands of automation and the need for providing computing facilities to schools:

"Because the Americans lost no time in developing the potentialities of automation (although -- a familiar story -- the subject was pioneered in Britain), they are not only reaping its benefits before us but also meeting successfully many of the concomitant problems; and there are now many senior high school and junior college courses in various aspects of computer studies designed to educate American students for the world in which they are going to live. In this country there is an urgent need for research into the most viable and profitable ways of making computing facilities available to schools and for using the facilities so provided." (Broderick, 1968:93)

Apart from efforts in attempting the construction of the school timetable with the computer, not much happened in Britain during the 1960's in using the machine in school management or administration (Bird, 1984). Bird has written in some detail the interests shown by various parties since 1960 in computer aided timetabling and he identified a brief article by an unnamed author in the Times Educational

Supplement in July 1968 as one of the earliest accounts of computer use in school administration outside timetabling. The article reported the use of an Elliott 803 computer at Lanchester College to produce 'numerical summaries and sublists' from a limited pupil record database. The reason for the slow tempo of development in British schools in this field was mainly due to the remoteness and slow turn-around times for batch processed work in most mainframe computers, as Bird believes. He cited other reasons too for the low interest shown by schools such as lack of proper programs to do the job, lack of people able to communicate with the machines, lack of in-service training and poor dissemination of the possibilities.

The monumental paper in Britain which Bird calls the 'Bible' on pupil record systems for mainframe computers is the LAMSAC report entitled "Towards a Computer Based Education Management Information System" published in 1974. This report was written for reference by Local Education Authorities contemplating computerisation of pupil records on large mainframes. Not being any plan for action, little was initiated and developed from it down to the schools' level. LAMSAC reported again four years later, publishing in 1978 the paper "Computer Assisted School Timetabling". Thus it seems that British schools, with their multifarious option schemes being offered to students, have been struggling for over a decade to find a solution with the computer to ease the task, with success finally achieved in the 1980's. Perhaps the reason behind it is the often lamented 're-invention of the wheel' whereby the simultaneous development of software for the same task by different interested parties on different computers -- and without much communication either between the people or machines, with a consequential waste of much resources.

The main thrust in Britain towards using computers in school administration came with the arrival of the technology of microelectronics. Faced with the question of how education was to respond to the microelectronics revolution, the then Under Secretary of State at the Department of Education and Science, Mr. Neil MacFarlane, announced in March 1980 a four-year programme for schools costing nine million sterling pounds (Fothergill, 1981). The Programme was responsible to the Departments of Education of England, Northern Ireland and Wales, and its work was

undertaken through contracts arranged with them and administered by the then Council of Educational Technology. Rightly or wrongly, the main theme of the Microelectronics Education Programme (MEP) was on the academic side alone, and administrative uses were simply ignored. Nevertheless, the injection of micro-computers into secondary schools (and primary schools a year later) opened a side route for the development of Computer Aided Administration (CAA) in British schools.

With its origination in schools and without any central policy or guidance, CAA in Britain passed through an unfocussed state. Bird (1984) described the situation as follows:

"If the Local Authority asks for the first time at this stage - 'Where are we now?' - in terms of all its schools, the answer is likely to be that things are in a fair degree of chaos!"

Watts agreed with this when he talked about 'home-grown' software by individual parties:

"The main thrust towards CAA, using microcomputers, originated in the schools and as such was, almost inevitably, amateur, ad hoc, not easily generalised, bug-ridden and unintegrated. On the other hand it was also widespread and useful to the individual users. Similarly, experience in Local Education Authorities has also proved extremely haphazard" (Watts, 1985).

This is an important comment and the writer sees much the same thing happening in Hong Kong and central leadership in the area of CAA is a necessity to avoid or remedy such pitfalls (see Chapter 8).

When this study began in 1985 in the U.K., many acronyms existed as shorthands for Computer Aided Administration in schools such as: SAM (School Administration by Microcomputer; in Ransome, 1984), MCBA (Microcomputer Based Administration; in Bird, 1984), SIMS (Schools Information Management System for the Bedfordshire Education Service, 1985), SCAMP (Schools Computer Administration and Management Project in Scotland, 1979), and SIAM (Schools Integrated Administration & Management Package, developed by a Scottish company called Piarco; in Boswell, 1981). CAA was the simple and general term used by the

then Inner London Education Authority (ILEA) and the same term is adopted in this thesis for reasons already explained in Chapter 1. According to Bird's (1991) recent report, SIMS claimed to have obtained contracts in 1990 from up to 75 % of all LEAs making it the recognised "brand leader" nationally.

Historically, the biggest CAA project in the United Kingdom took place in Scotland where the Schools Computer Administration and Management Project (SCAMP) has been developing since 1978. With central government support, their system was deliberately aimed at designing for operation at all levels - school, regional, and Scottish Education Department. During a visit by the writer in 1986, Tomasso (Director of SCAMP) commented that the project proved the more efficient and effective use of on-site computers at schools compared with time-sharing terminals linked up to a central place. The SCAMP developments then had already shifted focus on micro- rather than mini-computers.

Developments in CAA have grown in the U.K. with an increasing number of LEAs coming to realise the potential benefits and at the same time the need for standardisation. The LEA in Croydon, for example, decided to put a 16-bit machine into every secondary school with their own integrated CAA software. Bedfordshire too, launched their SIMS (Schools Information Management System) around 1986. The Inner London Education Authority (ILEA), formerly the biggest LEA in England, completed its two-year pilot project with a final report delivered in 1985. A central policy and decision was reached in the same year to put into every secondary school (about 150 in all) within its Authority a microcomputer for administrative purposes by 1988. A new CAA Development Group was and, with the joint effort of a commercial software house, aimed to introduce a standardised CAA system to all secondary schools. In the long run, ILEA aimed at an Authority-wide fully integrated secondary CAA system which also integrated with other administrative computing and a communications network, as recommended in its CAA Pilot Project Final Report 1985. However, because of the demise of the ILEA after the Education Act 1988 and the establishment of the new London Boroughs, the original ILEA project was not realised.

In the mid-1980's, at the time when this study began, the CAA impact in U.K. had reached just to the level of LEAs but not the state level of the Department of Education & Science though there had been a submission through the British Computer Society in 1984 to urge for concern. Since then, however, there has been much development on CAA over the whole country; especially after the 1988 LMS movement (see Section 4.5.1).

4.3.3 The Hong Kong Scenario

Similar to many other countries, computers when first put into secondary schools in Hong Kong by the Education Department in 1982 were solely for teaching purposes. Currently more than 300 schools are offering Computer Studies/Awareness courses, representing over 90% of the total number of secondary schools in Hong Kong. There is yet no central government policy regarding CAA and the Education Department has held aloof from the field of CAA in schools so far. However, with the availability of microcomputers within their premises, schools have ventured to put the machine to administrative use. A few secondary schools, on their own initiative, were involved in CAA at the end of the 1970's. The most prominent of such activities was marked in 1981 when one school began using a mini-computer system with three time-sharing terminals all dedicated to CAA.

On one occasion in February 1988, a "Survey on the Use of Computer in School Administration" was issued by the Education Department to secondary schools for data collection. Unfortunately the result of this survey was not made accessible to the public, neither was there any follow-up action. This illustrates the 'closed-door' administration style of the local Education Department and research data collected by its education research unit is often restricted only to internal government use. Linking up to what has been said in Chapter 1 about a similar lack of openness towards educational research in schools, the difficulty of researching and innovating within the culture of Hong Kong's educational setting may be appreciated.

In 1983 the writer conducted a survey on CAA among local secondary schools (Fung, 1983). From the total of 376 secondary schools surveyed then in the territory, 73 out of the responded 207 schools (22%) reported using some form of CAA with microcomputers. This indicated the interest shown already at the time by many schools in CAA. A similar survey done in March 1991 reviewed a different picture (Fung, 1991). The total population of 350 secondary schools in the government and aided sectors was surveyed, 168 out of the responded 197 schools (85%) indicated that they use some form of administrative computing. The popularity of CAA in schools has thus risen quite dramatically over the past few years and the majority of secondary schools in Hong Kong now use CAA, though to different extent (see Fung, 1991 for details).

Development of CAA in Hong Kong since the early 1980's has followed two different paths:

- (1) self-developed software by teachers or staff of individual schools for their own use, similar to the early situation in British schools; and
- (2) development by a commercial software house of an integrated software for secondary schools - the Hong Kong School Administration System (HKSAS).

It seems quite a natural phenomenon for schools to take the first path when they were initially attracted to CAA. By using their own existing available resources, both human and technological, this appeared to be the most sensible and financially economical way. Software development in such cases often followed the application/task-oriented approach (see section 4.4), with the handling of test/examination marks and student reports being most popular. This situation was much similar to the experimental phase of CAA development in British schools as well as in the Netherlands (see Visscher et al., 1991).

In contrast, the HKSAS development attempted to take a more comprehensive approach, details about this software package are listed in Annex D. Currently about thirty secondary schools are using this software package on microcomputers dedicated to CAA, including users who initially attempted self-developing their CAA software. The HKSAS system consists of five major modules covering the areas of student data management, test/examination results management, timetabling, teachers' leave and substitution management, and school finance management. Hurst, London University Institute of Education, considered the HKSAS an impressive example of an integrated package dedicated to school management and a fairly rare CAA software at his time of writing (Hurst, 1986).

Since 1985, many sophisticated packages for business applications have been developed in the market. Such integrated packages usually encompass the major functions of word processing, database, spreadsheet, graphics, telecommunication, or even a time manager. Examples of such software that are popular in Hong Kong include Lotus-123, Symphony, Framework, Windows, and DBaseIV. All local schools self-developing their CAA software make use of such general packages. The HKSAS system, so far, remains the only available dedicated package developed commercially for CAA with no counterpart comparable to its inclusiveness. Commercial software houses are not interested in investing effort for such developments. The main reason is that financial return is limited by the small market of only a few hundred secondary schools in Hong Kong. Added to this is the constraint that there is no central policy on CAA yet in Hong Kong (perhaps the situation will change with the new SMI 1991). This is in contrast to the U.K. situation where the LMS policy (1988) strongly supports schools for CAA. Local schools interested in CAA have to finance the innovation totally by themselves and thus it is difficult for a commercially developed CAA package to find entry into schools.

The Education Department, although not involved with any CAA at the school level, does make use of computers in its own administration. Teachers' payroll for all government and aided schools, for example, has been computerised since the

1970's. Pupils' allocations to school places are also done by computers in primary one, secondary one, and secondary four. A recent development by the department is the 'Pupil Record System' that keeps track of a pupil's schooling history all the way through primary one to secondary five. The main purpose of this computerised system is to help identify school drop-outs and make remedy the soonest possible.

Another case worth mentioning about CAA was a pilot project done in 1986 by the Hong Kong Examinations Authority and the writer. The attempt was a trial for schools to enter school candidates' data for examinations using floppy disks. Technically the project was successful but it was aborted due to insufficient school support because CAA was not then as popular as today in schools.

4.4 CAA APPLICATIONS & APPROACHES

Discussing data processing in a school system and the demands of educational 'intelligence', Wagner (1964) distinguished three different levels: (1) the superintendent's level, (2) the principal's level, and (3) the teacher's level. His approach based on a dimension of the needs of these three parties concerned in fulfilling their respective responsibilities. Wagner (1964) identified major areas of CAA applications for the three different levels as follows:

- (1) for the superintendent -- pupil enrolment, financial statements, and community survey reports;
- (2) for the principal -- attendance accounting, scheduling and registration of students, and test scoring and reporting;
- (3) for the teacher (counsellor included) -- supply of data into the classroom for the benefit of the student, receiving and reporting outgoing classroom information.

Similarly, Broderick in U.K. made his forecast in 1968 of the future wider part that the computer will play in educational administration concerning the teacher, the head, and the Local Educational Authority.

In a wider perspective, the writer would suggest that CAA can also be viewed at three other different levels: (1) the institutional level, (2) the district level, and (3) the state level. The planning and design of CAA applications vary of course at each different level, but it is possible to discern three general approaches common to all. These approaches to the design of CAA are discussed in the following sections 4.4.1 to 4.4.3.

4.4.1 The Task-oriented Approach

The majority of early designs on CAA, when they were in the experimental phase, dealt with the subject at the school level by the 'application-oriented' or 'task-oriented' approach. The computer was used as a tool to tackle problems such as timetabling, option choices, pupil records, marks and reports, attendance, statistics reporting, etc. Sometimes described as "a solution in search for a problem", the computer was brought in to give help. This was, and still is, the usual situation especially for self-developed software in schools working in isolation.

4.4.2 The Functional Approach

A second approach to developing CAA systems is the 'functional approach'. Many institutions of higher education in their early years of computerisation adopted this approach. Different departments would then computerise according to their own functions, resulting in a non-integrated system usually at the end. Sharing of information across departmental or administrative boundaries was virtually non-existent or very limited and master files were kept by individual departments containing often overlapping of data.

Nevertheless, looking at the potential applications of CAA by area can give us at least a picture of what can be done. In Annex B.1 of this thesis is a list of CAA applications produced by the Minnesota Educational Computing Consortium (Haugo, 1981). The list resulted from a study of feasibility and interest in administrative uses of the microcomputer in school districts of Minnesota in 1979.

A close similarity is found when the above list is compared to available software which Spuck & Atkinson (1983) reported as listed in Annex B.2.

With a wider perspective but still in a functional sense, the LAMSAC (1974) report, for instance, suggested the following considerations for what a pupil record database can provide:

1. Information for administrative decisions
2. Information for counselling decisions
3. Information for planning decisions
4. Information for research.

Development of CAA in U.K. and Hong Kong has gradually moved into the popularization phase in recent years, the LMS (1988) policy and SMI (1991) will undoubtedly add much impetus. More and more people have come to realise the limitations of both the task-oriented and the functional approaches (e.g. Visscher, 1991). A third approach - the 'integrated approach' - is being now sought.

4.4.3 The Integrated Approach

In the past when a computer was brought into an institution and the task-oriented job-by-job conversion of existing procedures was pursued, no effort was made to integrate the data for various other applications. Such an approach was usually disappointing in that the cost of the equipment outweighed any perceived savings or advantages over the old manual system. Dean (1961) compared this method with that of building a house one room at a time without regard to an over-all plan or to the relationships existing between the rooms of the house. This could result in the garage being placed on the second floor.

The functional approach to CAA as described was to combine and/or co-ordinate input and output of various applications in each of the above areas within departments to take advantage of the extra capabilities of the computer system. Even this could bring about at most partial integration of the information in certain areas

only. Dean (1961) noted this method as like building a house with a planned relationship of the bathrooms to the bedrooms, but not to kitchen, front door, garage, or living room. This approach was commonly used with the integration being done in the areas of greatest interest and response, while other areas might be omitted.

To take advantage of the full capabilities of medium-to-large-scale electronic data processing systems, it is suggested that an integrated approach is necessary, i.e. design a total information system that will serve the whole institution or organisation to derive optimum outcomes. This is comparable to having an architect design a house to suit the needs of a particular family.

The integrated systems approach is well supported by many other writers (see Visscher et al., 1991). Important as it is in the 1990's, the use of the term can be traced back historically to the 1960's. Wagner (1964), for example, expressed the need for an over-all plan throughout the school system. Grossman (1964) said likewise in discussing about the objectives of an integrated information system for the whole school district.

Computerised information processing systems are useful administrative aids, in the writer's view, because the volume of data they can process is large and the speed is fast. Usually many people are involved in the creation and use of the data and its information content. All of these people and all of their needs constitute the total system. The danger of falling into the trap of a narrow perspective is best summarised by what Myer has said:

"Unfortunately, we humans tend to categorize data and its processing into separate, distinct tasks and then deal with each task individually. As a result, we lose perspective of the system as a whole. The design of an integrated, effective data processing system is possible only when the total system is considered. A piecemeal approach can yield only piecemeal results!" (Myer, 1964)

'Synergy' is perhaps the best word to describe the prime objective of going for a total integrated information system in CAA, which demands that a holistic analysis be applied to the information needs. As Schure (1968) puts it, "... that there

be a systems integration of all the available resource components, with the unique potentialities of every element aligned to produce a more effective system as a whole than any resource used singly."

The concept of total information systems is thus not new, and it is applicable not only to the institutional level but also to the district and the state level. In the writer's view, Dean's (1961) analogy of building a house may be extended to one of town-planning as a whole when developing CAA at the regional level.

Difficulties exist of course when the total integrated systems approach is put into practice. Due to the large amount of reorganisation and rethinking which must go into its design, it was rarely implemented. But as more parties step into the 'population phase' of CAA, the cry for integrated systems and standardisation becomes louder and clearer. Some Local Education Authorities in the U.K. picked up the message and acted promptly, and for those who did not, Bird (1984) gave them the following piece of advice:

"Local Authorities which ignore the development of MCBA (MicroComputer-Based Administration) in schools are likely, in time, to be faced with a veritable 'can of worms'. Much time and a great deal of money may well have been wasted through lack of direction and advice. Above all a great opportunity will have been lost."

Integration and standardisation must not be equated, however, to conformity. While recognising the need for standardisation with central leadership in CAA development using the integrated approach, school autonomy must be respected at the same time. Enough flexibility must be allowed for so that schools can maintain or develop their individual characteristics. Both school users on the peripheral and office users at the central must be able to perceive and enjoy the benefits from a successful CAA system implemented on a regional level. A central top-down approach neglecting this critical factor will create unnecessary resistance, in the opinion of the writer, from schools at least in the Hong Kong situation. The issue of standardisation versus flexibility is a difficult one to resolve, and Visscher (1991) has provided a good example for reference in his SCHOLIS project from the

Netherlands. The writer also has suggested one approach to solve this dilemma in Chapter 8 of the thesis. In this respect, Caffrey's (1963) historic words can still serve as a guideline in the 1990's:

"It is obvious to everyone involved that it will be necessary to share knowledge and even responsibility for basic design and terminology if the full values of automated systems are to be realized. At the same time, fully aware of the totalitarian tone of demands for uniformity at all levels and in varying agencies, it is recognized that diversity must be tolerated and that compatibility is an alternative to conformity among systems."

4.5 *THE FUTURE SCENARIO: A SYSTEMS PERSPECTIVE FOR CAA IN HONG KONG*

Following the miniaturisation of computer hardware, microcomputers have become increasingly a substantial tool in CAA. Batch-processing or time-sharing terminals linked to mainframe computers appear dated. The vision in place for Hong Kong should be a system using mainframe computers at the central education office, which are networked to minicomputers at the district level, and finally linked to schools with their own user systems on microcomputers.

Long-term policy and planning of CAA are needed under central leadership, as the Americans and most responsive LEA's in the United Kingdom recognised. A total systems perspective is the necessary criterion to make ends meet: that of the central Education Department and those of individual schools/institutions. All parties in Hong Kong should be able to benefit from a well-designed integrated CAA education system.

4.5.1 *LESSONS FROM OTHER COUNTRIES*

There is evidence showing that movement towards the vision described in the previous section for Hong Kong has gathered pace in other parts of the world during the period of this study . Semrau's (1990) case study reviews the latest applications

of computers and software for school administrative functions as used by the Arcadia and Burbank school systems in USA. Her article provided an in-depth look of how the technology is being used within the central district office and the local school sites. Bluhm & Visscher (1990) have reported on the current state of administrative computing in the USA as well as in the Netherlands. Their findings fit well with the vision -- networking of school microcomputers to a district mainframe to permit building personnel more control at the local level has made strides in USA. Schools participating in the SCHOLIS project in the Netherlands too, have actively promoted distributed data-processing with networking and 4th generation query language (Bluhm & Visscher, 1990: 116).

In England, LEA's and schools are moving also in the same direction. Thomas's (1989) article is a typical example of CAA in British secondary schools and his concluding recommendations are that the LEA's should set up at the earliest time possible a series of pilot schemes to devise (a) the most reliable and economical use of networking within the institution; and (b) the most reliable and economical use of networking between the institution and the centre (Thomas, 1989: 204).

CAA in England has had a strong impetus particularly after the 1988 Education Act that demanded that all LEAs should create a scheme of local management by April 1, 1990. Initially a decentralisation of financial control, the LMS (Local Management of Schools) revolution soon reflected the reality that increased local financial management fundamentally altered the total management system of single institutions and by the changed relationships between Authority and school, of the LEA itself (Thomas, 1989: 191). There is also a shift of emphasis from the need for schools to have 'financial and administrative accounting systems' to the need for 'information systems' as highlighted by Lancaster (1989).

As for CAA in Hong Kong, it is difficult to delineate the present developmental stage between the experimental phase, popularization phase, or transition phase (see section 4.3). In quantitative terms it is confident to say that the popularization phase has been reached for secondary schools already. But in terms

of development of the CAA applications, individual schools vary much indeed. Many schools still depend on amateurish self-developed programs, while some have stepped into the integration stage using the HKSAS. However, even the HKSAS with a modular structure and a 'single entry - multiple use' design is still just an administrative system rather than a management information system (following a differentiation between the two levels of IS by Lancaster, 1989). In other words, the applications are designed mainly for improving the efficiency of clerical activities rather than for improvement of the effectiveness of management decision-makings; although the timetabling module in the HKSAS may be ranked in the latter category.

The availability of relational database management systems, fourth generation programming languages and a standard query language has not much impact yet to CAA in Hong Kong. Since neither the government nor any of the higher education institutes is involved in CAA, research and development in this area are seriously neglected. And because of the low economical return of the limited market of HKSAS, its further development by the software house towards the ideal of a school management information system supporting both clerical and management activities is unlikely.

However, changes are anticipated to be forthcoming too in Hong Kong. The following recommendation, quoted from a recent report "The School Management Initiative" issued by the Education and Manpower Branch and Education Department of Hong Kong that sets the framework for quality in Hong Kong schools in the years ahead, is a strong piece of evidence:

"ED should obtain expert help to define the information needs of the schools education programme and develop appropriate management information systems. The recommendations in this chapter will lead to a range of management information needs in schools and ED very different from that which is now available or thought desirable by managers. There must be an urgent re-appraisal of these needs."
(EMB & ED, 1991:34)

In the 1980's computers entered schools to aid in a variety of administrative tasks, the next decade will be time for applying the machine to the level of supporting

management. While Lancaster (1989) distinguishes the upgrading level of application using the term 'Management Information Systems' instead of 'Administrative Systems', writers in the USA use the term 'Decision Support Systems' (Fisher et al., 1990). Most likely, administrators in the 1990's will be aided by the computer not only in routine administrative tasks, but also in all steps of the decision-making process, namely: problem identification, prioritising of criteria, data organisation, evaluation of alternatives, choice of an alternative, 'what-if' analysis and implementation (Fisher et al., 1990:92).

CHAPTER 5

RESEARCH DESIGN & METHOD

5.0 INTRODUCTION

This chapter is concerned mainly with the research approach and method of the thesis. The research involved two cases in CAA. The approach was determined by the three stages of the research: (1) ILEA study in U.K. - researcher as observer; (2) School study in Hong Kong - researcher as partial participant in the early stage, then as a trainer for CAA change; (3) Three schools study in Hong Kong - researcher as verifier of data collected in (2). These roles are also explained in Chapter 6 and Chapter 7 where the studies are respectively reported in detail. In this chapter, the first sections explain the stance of naturalistic inquiry in contrast to the rationalistic approach (see below for meanings of these terms). These include a justification for the contribution of case studies in education. The research framework of the thesis is naturalistic and qualitative rather than rationalistic or quantitative (meanings of these terms used are clarified in the sections that follow).

Since the main theme of the study is the process of managing an innovation, the writer considered it appropriate to adopt the case study approach for the ILEA and the Hong Kong school to explore as fully as possible *how* the innovations were carried out. The ILEA case was a CAA innovation on a regional base for a local education authority in U.K. The second case study concentrated on the CAA innovation of one school in Hong Kong. For the part of the research done in Hong Kong, there were several other reasons for adopting a qualitative approach. One reason was that when this study began in 1985 the number of Hong Kong schools using CAA was limited (see Section 4.3.3), and the stage of development was only embryonic. The time then was not appropriate in the Hong Kong context for any

large-scale quantitative research such as the CAA impact studies in schools. Nevertheless quantitative methods were useful in reviewing the general CAA picture in Hong Kong schools and such numerical data has been incorporated in Section 4.3.3. Furthermore, as hinted in Section 1.1, entry into Hong Kong schools for research has been, and continues to be difficult, especially if the study uses qualitative methods (the difficulties will be further discussed in Section 7.1 regarding the context for educational research in Hong Kong). Thus a 'participant-trainer' approach was adopted for the case study in Hong Kong (see Section 5.3.3).

The thesis did not set out to test some preconceived theories or hypotheses but to work on the problem identified earlier in Section 1.1 -- how to ensure that an innovation like CAA is successfully managed. Both the research design and the framework for study emerged during the time in the ILEA and in the Hong Kong school.

5.1 TWO PARADIGMS IN EDUCATIONAL RESEARCH

The search for knowledge and understanding in social science has essentially developed along two separate paths. The long history and success achieved by scientific theory-testing and experimental methods in the natural sciences have, not surprisingly, much influenced and helped established a firm footing in educational researches. Descriptors commonly identified with such methodologies in the first paradigm of educational research would include such terms as 'classical', 'deductive', 'experimental', 'rationalistic', 'logical-positivistic', 'agricultural-botany', 'quantitative', 'statistical', 'sampling', 'reliability', and 'objectivity'. Students with training from a science discipline (and the writer is one of them) are familiar with such controlled, experimental activities.

In contrast, a second paradigm which the writer has observed from literature on educational research is now also quite widely used. This is concerned not so much with law-testing but rather the generation of theory from the field in the live.

Descriptors belonging to this paradigm would include 'naturalistic', 'inductive', 'anthropological', 'qualitative', 'phenomenological', 'ecological', 'participant-observation', 'ethnographic', 'illuminative', and 'action approach'. What the researcher did, from his time in London, was to produce a model for promoting effective CAA implementation in Hong Kong and this could be described as "the generation of theory".

5.1.1 RATIONALISTIC versus NATURALISTIC

Owens (1982:2) distinguished the two paradigms of systematic inquiry in educational administration as 'rationalistic' and 'naturalistic' relating to the 'two modes of thought' -- deductive and inductive. The traditional, long-dominant rationalistic paradigm is essentially associated with deductive thinking and logical-positivist views of 'knowing' and 'understanding' social and organisational phenomena. The naturalistic paradigm, in contrast, is essentially based upon inductive thinking and is associated with phenomenological views of 'knowing' and 'understanding' social and organisational phenomena. (Ibid.: 3)

The rationalistic approach, a standard approach to inquiry in modern science, begins with an existing theory to set up a problem which is then tested in the field. Quantitative measurements and techniques are involved both in data collection and analysis. Six basic assumptions characterising the rationalistic paradigm have been listed by Owens (for details, see Owens, 1982:4).

The naturalistic approach which the researcher adopted in part, refers to social inquiries that (1) primarily employ direct contact between investigators and actors in the situation as a means of collecting data, (2) use emergent strategies to design the study rather than a priori specification, (3) develop data categories from examination of the data themselves after collection, and (4) do not attempt to generalize the findings to a universe beyond that bounded by the study. These are considered to be the salient modal characteristics of naturalistic inquiry by Owens (Ibid.: 7) and his list of six postulates concerning naturalistic inquiry clearly distinguishes its inductive

nature from that of the rationalistic paradigm (for details, see Owens, 1982:6). These are the meanings of the term 'naturalistic' used by the writer in the introduction of this chapter.

5.1.2 NATURALISTIC INQUIRY INTO REALITIES

The standpoint of researchers in the naturalistic paradigm, which influenced the design and approach in this thesis would be best understood by reviewing the thinking of some prominent writers in the field.

Stenhouse (1979), for instance, in discussing comparative education, expressed himself as follows:

"In its essence, comparative education is less concerned with predictions and possibilities than with that which is accepted as actuality occurring in time and space. Its happenings are located within the coordinates of living rather than within the coordinates of theory. It is descriptive rather than experimental. It deals in insight rather than law as a basis for understanding." (Stenhouse, 1979: 5)
"... our grasp of realities -- or as I might prefer to call them, actualities -- is improved by descriptive studies, ... It is the fruits of these I am describing when I speak of 'insight rather than law as a basis for understanding'." (Ibid.: 6)

Hamilton and his colleagues, in talking about illuminative evaluation in education programmes, express their criticism about rationalistic approaches by saying,

"Characteristically, conventional approaches have followed the experimental and psychometric traditions dominant in educational research. Their aim [unfulfilled] of achieving fully 'objective methods' has led to studies that are artificial and restricted in scope. The authors argue that such evaluations are inadequate for elucidating the complex problem areas they confront, and as a result provide little effective input to the decision-making process." (Hamilton et al., 1977: 4)

Systematic inquiries in social sciences distinguish themselves primarily from scientific inquiries in that the former seek to understand about human beings whereas the latter is about matter and entities in the natural sciences. Under the naturalistic paradigm, two further sets of concepts based on different assumptions lead to a further division into the naturalistic-ecological premise and the naturalistic-phenomenological premise. The ecological hypothesis asserts "that human behaviour is so significantly influenced by the context in which it occurs that regularities in those contexts are often more powerful in shaping behaviour than differences among the individuals present. The phenomenological hypothesis claims, on the other hand, that one cannot understand human behaviour without understanding the framework within which the individuals under study interpret their environment, and that this, in turn, can best be understood through understanding their thoughts, feelings, values, perceptions, and their actions" (Owens, 1982:5).

Although Owens was talking only about inquiries in social sciences in general, the writer finds it interesting to see relevance not only in the naturalistic-phenomenological approach in conducting the research, but also direct linkage to the current perspectives of managing change in realities (see Section 3.11)

5.1.3 SYSTEMS APPROACH & ACTION APPROACH

In the language of other writers, naturalistic-ecological and naturalistic-phenomenological premises are sometimes expressed respectively as the "systems approach" (see Chapter 2 on Systems Theory) and the "action approach". Recognising the individuality of different human beings, phenomenological inquiries seek for meanings and perceptions of the 'actors' involved. The "actor's frame of reference", as it is called, often outweighs the "researcher's frame of reference" and the "systems perspective". About the 'action approach' as an alternative to the 'systems approach' in social science research, Silverman (1970) presented a number of arguments. In the opinion of the writer, these issues are as valid and important in the 1990's as when they were first developed, not only in educational research but are expandable to the area of managing change (see also Section 3.11).

1. The social sciences and the natural sciences deal with entirely different orders of subject-matter. While the canons of rigour and scepticism apply to both, one would not expect their perspective to be the same.
2. Sociology is concerned with understanding action rather than with observing behaviour. Action arises out of meanings which define social reality.
3. Meanings are given to men by their society. Shared orientations become institutionalised and are experienced by later generations as social facts.
4. While society defines man, man in turn defines society. Particular constellations of meaning are only sustained by continual reaffirmation in everyday actions.
5. Through their interaction men also modify, change and transform social meanings.
6. It follows that explanations of human actions must take account of the meanings which those concerned assign to their acts; the manner in which the everyday world is socially constructed yet perceived as real and routine becomes a crucial concern of sociological analysis.
7. Positivistic explanations, which assert that action is determined by external and constraining social or non-social forces, are inadmissible. (Silverman, 1970:126-141)

The ecological premise (systems approach) and the phenomenological premise (action approach), it can be said, derive their ground respectively from the contrasting views of reality in life: "On the one hand, it seems, society makes man, on the other, man makes society" (Silverman, 1970: 141). When either approach is taken in a strict and limited sense, it comes as no surprise, as Silverman said, "that each approach should appear to stress merely one side or another of the same coin" (Ibid: 141). Such a complementary view of the systems approach and action approach, as

pointed out by Silverman, is the argument of Percy Cohen. According to Silverman,

"Cohen distinguishes a 'holistic' from an 'atomistic' approach: the former seeks to explain the action of parts of a system in terms of the nature of the whole, while the latter views the system as an outcome of the action of the parts. ... Thus both approaches have difficulty in explaining facts which the other is able to take for granted: the Action approach tends to assume an existing system in which action occurs but cannot successfully explain the nature of this system, while the Systems approach is unable to explain satisfactorily why particular actors act as they do" (Ibid.: 142).

Cohen's complementary view falls in line with the essence and spirit of the general systems theory. In a broad sense, a system consists of a number of interacting parts -- interactions exist among the parts, between the system and its constituents, as well as with the environment in which the system is embedded -- and the total system is more than just the sum of the parts (See Chapter 2). Thus the so called 'systems approach' in the ecological sense is incomplete by itself in only recognising the system's performance and effect, whether internally or externally. To understand the process within the system, internal interactions among the constituents have to be considered. Thus in studies of processes in social systems where human actors are concerned, due attention must be paid to the action approach. Although the researcher has not used the action approach in the strict sense as described by Silverman (1970), he has adopted the term 'action approach subroutine' (see Section 6.6.1) in his model of managing the innovation process. In other words, while Silverman's (1970) argument is about the "actor's frame of reference" versus the "researcher's frame of reference", the researcher has adapted it in practice versus the "change agent's frame of reference" in change management. This is also what Fullan (1991) has stressed in change management as understanding the subjective meanings or perceptions of actors about innovations (see Section 2.0)

5.2 CASE STUDY IN EDUCATION

It is now quite commonly recognised that case studies in educational innovations can significantly contribute to the accumulation of knowledge. As Simons has said,

"The detail study of instances of innovation could advance our understanding of how schools deal with change and thus inform all levels of curriculum decision-making." (Simons, 1971: 178).

Although Simons was talking about curriculum innovations in schools, the point she made is equally valid for innovations generally in educational systems.

The term case study is an umbrella one for a family of research methods having in common the decision to focus an inquiry around an instance (Adelman et al., 1977:140). Case study research may be distinguished according to its initial set up into two different categories. In the first category an issue or hypothesis is first given, and a bounded system (the case) is then selected as an instance drawn from a class. In the second category, a 'bounded system' (the case) is given, within which issues are indicated, discovered or studied so that a tolerably full understanding of the case is possible. The most straight-forward examples of 'bounded systems' are those in which the boundaries have a common sense obviousness, e.g., an innovatory programme. (Ibid.: 141). It is quite obvious, then, that this thesis on CAA innovation falls into the second category described.

The resurgence of interest in using case study in educational research is chiefly due to the recognition of weaknesses in the classical rationalistic approach. Stenhouse has expressed such feelings in saying,

"The statistical assessment of probabilities is the basis of a decision-making strategy which works rather well in industrial or agricultural settings and in discriminating between hypothesis derived from theory. But many feel that the attempt to deploy it to evaluate educational and social programmes, thereby guiding decision-makers by law-like predictions, has exposed serious weakness in the paradigm." (Stenhouse, 1979: 9)

In support of case studies, Stenhouse called for the effort to develop in research a better grounded representation of day-to-day educational reality resting on the careful study of particular cases" (Stenhouse, 1979: 10).

In connection with computer technology in education, the need for more case studies is for instance strongly supported by the Social Science Research Council (SSRC). In their publication titled *Microcomputers in Education - A Framework for Research*, the SSRC recommended to have:

"A series of linked case studies to investigate the factors which promote or inhibit the uptake of new technology and its applications by schools" (SSRC, 1983:7);

"A cluster of case studies of highly resourced schools to observe styles of IT usage and their effectiveness" (Ibid.:8);
and, in particular,

"the importance of accepting hitherto disregarded or apparently unorthodox research designs is asserted" (Ibid.:6).

5.3 STAGES OF THE RESEARCH

For the ease of explanation, it is felt best to delineate the different developmental stages of study in the research followed by a discussion of design, method, and techniques employed in the fieldwork.

The research is a naturalistic one based on two case studies. The first case is on an authority-wide (regional) CAA innovation while the second is concentrated on a single school. Both the level and scale of innovation are different for the two cases. The former being at the district level involving the central education authority and about one hundred fifty secondary schools, whereas the latter is at the institutional level focused on one secondary school but also involving three others in 'cross-checking' or 'triangulation'.

The reasons for choosing two cases with a different context are in part situational and partly methodological:

- (i) It was opportune when the researcher started the research in 1985 that ILEA in London was in the initiation stage of its authority-wide CAA innovation. A study of its process is considered of relevance and valuable to this thesis.
Additionally, in retrospect, the researcher finds that period of study an important developmental stage for himself in preparation for the work to follow. Since there was no comparable region-wide CAA innovation undergoing in Hong Kong in the mid-1980's, the second case study was chosen to be institutional.
- (ii) Undoubtedly there were difference in level and scale in the two cases studied, but it was envisaged that there should be commonalities in the process of managing a CAA innovation in both. With a systems perspective, and subject to situational modifications, it is argued that a model for innovation would be equally applicable.

The table on the following page outlines the stages of the research with a brief description of the work involved and the time-line.

STAGES OF THE RESEARCH

<i>TIME</i>	<i>STAGE</i>	<i>DESCRIPTION OF WORK</i>
1985 1986 Oct - Jan	I	Information gathering in Britain, visits to schools and exhibitions in connection with CAA. Reading and review of literature. Contacting and liaison for entry to CASE STUDY (I).
1986 Feb - Mar	II	CASE STUDY (I) -- An observer case study in Britain of the Inner London Education Authority's (ILEA) Innovation on Computer Aided Administration.
1986 Apr - June	III	Interpretation of data, further literature review, writing up of report on CASE STUDY (I). Generation of a tentative model for an innovation process.
1986 1987 Sep - Feb	IV	Searching for target school in Hong Kong, making contacts and liaison for CASE STUDY (II) -- to go through a CAA innovation in reality at school using the researcher's tentative model.
--> 1990 Apr	V	Fieldwork at school, designing and piloting of interview-guide, data collection and cross-checking.
--> 1992	VI	Interpretation of data, refinement of model, and writing up of thesis.

5.3.1 INFORMATION GATHERING STAGE

Before stepping into the field, it was necessary for the researcher to equip himself with sufficient background understanding of the area under investigation, i.e. the use of computers in school administration. Several months were spent therefore in Stage I on reading of related literature; visiting schools; visiting computer exhibitions; meeting people with involvement in CAA like Tomasso (Director of the SCAMP in Scotland), Bird (Author of "Microcomputers in School Administration"), and Watts (Advisory Head of CAA Project of ILEA). This preliminary stage of broad information collection not only helped to put the researcher in the U.K. CAA picture but also paved the way for entry to Stage II through contacts made.

5.3.2 CASE STUDY I

ILEA was at the time the biggest Education Authority in England with about 150 secondary schools and a case study on how the CAA innovation was being planned and managed in it would be illuminating to others contemplating a similar venture. Within the limits of both time and resources, it was possible to do an observer case study for two months from February 1986 to March 1986 -- a period that happened to fall between the last stage before an authority-wide policy decision and the early stage of implementation. Given the access to documents from the beginning of the innovation, the process studied covered the following phases: Problem-identification, planning, program and development, experimentation, evaluation. The last two stages of implementation and dissemination were only slightly covered by access to documents as they emerge.

The distinction of the phases as above-mentioned neither suggests that all such phases existed in this case nor that they followed the order as listed. It is just to indicate roughly the stage reached in ILEA's CAA innovation when the observer case study ended.

Negotiation for entry to do the case-study was done through informal contacts directly with the Advisory CAA Head of ILEA. This key person was thus given an understanding of the researcher's interests, background, and experience in CAA. After gaining his acceptance, the study was formally proposed to the Research & Statistics Branch of ILEA for approval. It was made very clear in the beginning that the study was not an evaluative one and the main objective was to observe how the change process took place. A general framework (Annex A) was constructed at the start to help identify the aspects to be observed, but the research was guided mainly by what was uncovered during the study.

The two months of working with the CAA Advisory Head was really a treasurable experience for the researcher. The open-mindedness of both the Advisory Head and his team members are highly commendable. The researcher was very quickly accepted as a friend and a working member of the team. He was given not only a place in their office where he went daily but also shared a part in private gatherings (many in pubs!). The Advisory Head and the researcher were often seen in pairs for such activities like meetings, training workshops for schools, and planning sessions. The living-in and on-site working were really enjoyable, in spite of the hard-work of writing diaries for research purpose.

As a conclusion to Case Study I, a report was produced on "The Case of The Inner London Education Authority's Innovation on Computer Aided Administration" and submitted to the Authority's Research and Statistics branch for record. On the basis of the findings and experience gained from Case Study I, together with further literature review, a framework for an innovation process was then generated. The details of the theory and tentative model are described in Chapter 6. A year's research work at the then Department of Economics, Administration, and Policy Studies in Education (DEAPSIE) of the London University Institute of Education came to an end (the department now is renamed as Department of Policy Studies, Educational Administration). That also marked the beginning of Stage IV of the research when the writer returned to Hong Kong.

5.3.3 CASE STUDY II

Stage IV involved studying a CAA innovation in a school right from the start through the change process. It took three years before it can be said that the innovation has become institutionalised at the school -- i.e., when the innovation is no longer something new to the school but a practice which can be applied in routine operation (see Section 6.6.3). Details of Case Study II are reported in Chapter 7. Two delimitations should be made on this part of the research:

- (1) The researcher worked part-time on the study, with his full-time job as a school principal. Time constrained a larger and different kind of study.
- (2) Schools in Hong Kong are unfamiliar with school-based researches. 'Outsiders' in schools are completely out of place. Principals and teachers do not like to be disturbed or bothered even by questionnaires or interviews, let alone being observed in change management. (See also Sections 1.1 & 7.1)

These reasons made it impossible to do an ethnographic research at Stage IV similar to Stage II. It was viable only to take different roles for the researcher to study in detail the innovation process of a school adopting CAA. Such an approach involved the researcher with the case-school in the following relationships:

- (1) The researcher acted as an external CAA consultant to the case-school;
- (2) The researcher worked closely with the CAA group formed in the case-school through the several stages of awareness, attitude formation, decision making, and trial implementation; (see Chapter 6 for details on theory)

- (3) The researcher undertook the training for the CAA group in the operation of the computerised school administration system, thus providing ample time for contacts between researcher and individual group members to build up relationship and trust;
- (4) The researcher retreated into the background after the CAA system in the case-school was established. The teacher in-charge of the CAA group became key informant and contact between researcher and case-school.

The period for (1) to (3) lasted about one and half years the work of which in some ways resembled an action research. As defined by Rapoport,

"Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (in Clark, 1972: 23)

In contrast to applied research, action research emphasises "not so much on obtaining generalizable scientific knowledge as on precise knowledge for a particular situation and purpose" (Ibid.: 42).

Halsey, however, defines action research with an intervention nature, saying that it is "small-scale intervention in the functioning of the real world and a close examination of the effects of such intervention" (in Bell et al., 1984:41). Except for the point that it was more consultancy than intervention, many parallels can be drawn in Stage IV to action research as listed in the following:

- (1) Action research investigates problems identified by practitioners, and is essentially directed towards greater understanding and improvement of practice over a period of time.

- (2) Action research is situational, usually collaborative, participatory, and self-evaluative.
- (3) Action research is concerned with innovation and change and the ways in which these may be implemented in ongoing systems; which concentrates on problem solving virtually in any context in which a specific problem needs solving; and which provides the opportunity to develop theoretical knowledge. (Cohen & Mansion, in Bell et al., 1984:41-43)

The writer thus had several roles to play including that of an external change agent, a technical consultant, a trainer, as well as a researcher. This stage IV of the research lasted formally from February 1987 to March 1990 when a final structured interview was conducted with the CAA system supervisor of the case school SMC. The following remark was made by the key informant at the end of the interview,

"Teachers here often wonder what you are really doing here and why another school principal comes in so often to teach us use computers. Truly speaking, I had similar feelings too. But I understand much better now after the interview."

The above remark illustrates the rarity of school-based researches in Hong Kong schools, especially of the anthropological nature (see Section 7.1). It also has demonstrated, to the gratification of the researcher in a sense, that he had acted unobtrusively throughout. As Wilson has said, "The researcher must develop a dynamic tension between the subjective role of participant and the role of observer so that he is neither one entirely" (Wilson, 1977:250). The researcher has always kept one ethical point in mind -- that the school and people in it are real-life systems and care must be taken to avoid any unhealthy interference during or left by the research. The researcher has therefore always limited his advice and feedback to the CAA group only on technical matters while keeping himself alert but non-interfering (as far as possible) with other issues like the participants' inter-personal relationships,

individual actor's perception, and allocation of responsibilities. The researcher's observations or understandings were cross-checked only after-events at appropriate times when it was felt 'safe' enough with the key informant. In effect, this can be described as 'bracketing'.

Wilson has explained this skill of 'bracketing' in anthropological research as follows:

"Those who work within the anthropological tradition cultivate the skill of suspending (the phenomenologists call it 'bracketing') their preconceptions. They study prior research and theory as much as the traditional researcher, but they then purposely suspend this knowledge until their experience with the research setting suggests its relevance" (Wilson, 1977: 251)

To the researcher, however, 'bracketing' is dual-purposed. In addition to that as explained by Wilson, the other purpose is to safe-guard the system under study from unnecessary and unhealthy disturbance by intrusion on the part of the researcher. In this respect, the approach is significantly different from most organisational development (OD) programmes (see Section 3.12) or action research.

5.4 VALIDITY & CRITICAL SUBJECTIVITY

The final part of the research, Stage V, is concerned chiefly with cross-checking or triangulation. On the basis of the experience gained in Case Study I and II, together with reference from literature written on the impact of computerisation in business organisations, an interview guide was produced (Annex C). The target interviewee is the key person in-charge of CAA systems in schools. The interview guide was piloted and refined before putting into application. Four interviews were done in total, including the case-school and three others in Hong Kong that were using the same CAA system. Through contacts made with the supplier of the software system, three schools were chosen:

School WTS -	This school was an earlier user than the case-school SMC and was on-going with the system according to the supplier;
School YKH -	This school was also an earlier user than the case-school SMC but was not on-going with the system according to the supplier;
School NPC -	This school became a user of the system at about the same time as the case-school SMC.

The chosen schools were therefore comparable in many respects as regard to their CAA innovation. Being users of the same CAA system, issues related to the management of the innovation process can be conveniently focused with a reasonable degree of reliability.

In contrast to a pre-ordinate research design in rationalistic inquiry, this study does not put its emphasis on specified procedures dealing with such issues of external validity, objectivity, internal validity, and reliability. As Owens has explained,

"Because of the assumptions about the nature of reality and ways of understanding that reality in the naturalistic paradigm, the traditional concern for objectivity, validity, and reliability have little relevance for the design of naturalistic research. ... In order to avoid unreliable, biased, or opinionated data, the naturalistic inquirer seeks not some "objectivity" brought about through methodology but, rather, strives for validity through personalized, intimate understandings of phenomena stressing "close in" observations to achieve factual, reliable, and confirmable data." (Owens, 1982:10)

In summary, this research has been conducted with an effort adhering to the spirit which Stenhouse has expressed,

"The aspiration is not to produce objective data, for that is impossible. Rather it is to produce subjective data whose subjectivity is sufficiently controlled to allow critical scrutiny. The aspiration is to critical subjectivity, not to objectivity." (Stenhouse, 1978:33)

CHAPTER 6

A REGIONAL CAA INNOVATION CASE IN LONDON: ESTABLISHING A TENTATIVE MODEL

6.0 INTRODUCTION

This chapter contains the findings from a two-month period of observation of ILEA's (Inner London Education Authority) CAA innovation. ILEA was the biggest Education Authority in England with about one hundred fifty secondary schools before its demise after the Education Reform Act 1988. A limited case study on how it planned and managed the CAA innovation on a regional basis is part of this thesis. Within the limits of both time and resources available to the researcher, it was possible to be an observer for two months from February 1986 to March 1986 by which time the stage was reached for the decision-making of an authority-wide CAA policy to be implemented in the years following. Given access to documents from the beginning of the innovation, the researcher was able to study the innovation process covering roughly the following stages: problem-identification, planning, development of software, experimentation, and evaluation of pilot. These stages are collectively called in this thesis the initiation phase of ILEA's CAA innovation (see also Section 6.4 & 6.6.1). The distinction of these stages does not suggest that all of them in the ILEA case followed the order listed. It is meant to outline what happened in ILEA's CAA case as reviewed in the observer case study.

During the period of study, the researcher worked on a daily basis with the Advisory Head, Mr. PW, of ILEA's CAA project team. The prime objective was to examine the initiation phase of the innovation process. That period was also the opportunity for the writer to critically reflect on the process of change in the light of the literature concurrently explored (as included in Chapter 3). The outcome of this part of the thesis was the emergence of a tentative model for managing the CAA innovation process and a number of research questions for subsequent perusal in Hong Kong -- a second case study to be reported in Chapter 7.

After the introduction section, the chapter begins with a general description of the context for the CAA innovation both external and internal to the ILEA. It then considers the change process of the case, followed by discussion on the establishment of a tentative model for innovation and the research questions formulated for further study by the writer in Hong Kong.

6.1 THE ILEA CAA INNOVATION

The use of computers in school administration in British schools gained popularity in the early 1980's following the introduction of the machine into the curriculum. Many LEA's (Local Education Authorities), however, gave support only for using the machine in teaching and ILEA was one of the few authorities which formally explored CAA beginning in September 1982.

Negotiation for entry to do research in ILEA's CAA case involved primarily informal contacts first by the researcher with Mr. PW, the CAA Advisory Head, to provide him with an understanding of the researcher's interests, background, and experience in CAA. Having gained his acceptance, the study was formally proposed to the Research & Statistics (R&S) branch of ILEA for approval.

It was made clear to PW the CAA Advisory Head from the beginning that the study was not an evaluative one and the main objective was to observe how the change process took place. A general framework (see Annex A) was constructed at the start to help identify the aspects to be observed, with the research guided subsequently by what was uncovered during the course of the study.

6.1.1 CONTEXT FOR THE INNOVATION

As a country, Britain was the first to put a microcomputer into every school at the primary and secondary level (the Micro-electronics Education Programme -

MEP) principally for use across the curriculum in the early 1980's. No government initiative was made for computer-aided administration for schools at the time of study. There was an attempt, however, to look at the feasibility of putting pupil record systems on mainframe computers -- the Local Authorities Management Services And Computer Committees (LAMSAC) report entitled "Towards a Computer Based Education Management Information System" published in 1974. This report was written for reference by Local Education Authorities contemplating computerisation of pupil records on large mainframes. It was not a plan for action, thus little was initiated and developed from it into schools.

In the mid 1980's, CAA had attracted more attention in Britain. The Council for Educational Technology identified clearly in 1985 that:

"information technology offers the possibility of an improved educational environment, since the microprocessor's speed, capability and willingness to undertake boring and repetitive tasks can release teachers and their managers for more creative and satisfying work." (CET Information Sheet No.9, April 1985)

Being concerned that teachers and managers should be sufficiently well-informed to take sound decisions when choosing a system or strategy, this CET paper offered some practical tips on practical matters drawn on their experience of the past five years for the intending purchaser or developer of computer-based educational administration and management systems. But no guidance on managing the change was given in this paper. For the researcher this absence of guidance was a surprising omission as his knowledge of the literature and his own experience of change management would suggest. This omission was in part a contribution to the writer's thinking of the need to develop a model for managing the innovation process.

Local Education Authorities were thus left to their own initiative in CAA except for one thing -- the Data Protection Act introduced in 1984 as a result of the Committee on Privacy set up by the government in May 1970 headed by Kenneth Younger. The stipulations found in this Act had a striking resemblance to those listed in the 1974 LAMSAC Report for codes of professional practice in the handling of computerised personal private data records.

A survey carried out by the Education Management Information Exchange (EMIE) recorded, as at September 1983, that no less than fourteen LEAs in the country had some form of CAA in their schools. The comment by Watts (1985) on the LEA situation in CAA was "extremely haphazard" with variable interest from the different areas of ILEA itself. Bird (1984) also noted, in terms of implementation, that "Local Authorities which ignore the development of MCBA (MicroComputer Based Administration) in schools are likely, in time, to be faced with a veritable 'can of worms'".

6.1.2 CHARACTERISTICS OF ILEA

ILEA was then the largest education authority in Britain until its demise in 1989. Similar to other LEAs, it had total responsibility for its education system within the Authority. Under its Education Committee, Education Officers took charge of administrative work while the branch of Inspectorate was responsible for advice to educational institutions and to the Officers. The headteacher, working with school governors, usually had autonomy in managing the school and determining the curriculum. From the writer's observation in schools and discussions with headteachers using CAA, it appeared that it was headteachers who decided whether or not to adopt CAA. In addition, there were other branches or sections within the ILEA system, like teachers' centres, sports centres, and higher education institutions, which had either direct or indirect relation to secondary schools.

ILEA had a long and close relationship with the Greater London Council (GLC); for instance the Council's Central Computer Service (CCS) had been serving ILEA in different areas for years with its mainframe computers. For political reasons, the GLC ended in 1988. As a first step to maintaining its administrative computing services after the demise of the GLC, a plan was prepared in 1983 by ILEA. This led to the establishment in 1984 of a new Administrative Computing Unit (ACU), as an interim step. A consultancy firm had also been appointed to study the overall computing service needs of ILEA when the CCS service ended in 1988.

During the transitional two years after the demise of GLC the London Residuary Board (LRB) was formed as care-taker body.

ILEA was renowned for its innovativeness (in the general sense of the word) in education. The openness to new ideas and changes may be summed up by a remark once made by Mr. PW (CAA Advisory Head in ILEA): "Without commenting on how successful some innovations are, during the past ten to twenty years we have had a lot of new ideas in education, almost in a 'you name it, we have it' manner". To name a few of the then current innovations related to computers, there was (i) the recently started INDEX (Innovation and Development Exchange) by the R&S which stemmed from Recommendation No.1 of The Hargreaves Report (March 1984) *Improving Secondary Schools*; (ii) a project also handled by the R&S using government Education Support Grant money for developing Profiles of Achievement; (iii) all Divisional Offices had recently been given microcomputers for administrative work; (iv) about one-third of ILEA secondary schools were using JIIG-CAL for careers work and guidance for their students; (v) the use of FEROS (Further Education Record Of Students) and the DES sponsored FEMIS (Further Education Management Information System); and (vi) the linking with terminals to a British Library data base by most college libraries and one trial secondary school.

The 'climate' for educational change or innovation thus appeared to be a receptive one in ILEA.

6.1.3 CONTEXT FOR CAA IN ILEA SCHOOLS

Schools in Britain received the first impact of computer technology in their curriculum. The initial stage of introduction was as a new subject or discipline but the later objective was to use computers as a teaching medium across the curriculum. Support to schools and teachers both for primary and secondary levels in this respect was quite strong in ILEA with its own ILECC (Inner London Education Computing Centre) in addition to the Capital Region Centre of MEP which was also based in the

same building. With its own supporting and programme development team, ILECC had produced various software packages for teaching purposes across the curriculum. 'Hot-line' services were very helpful to teachers who had difficulties, and training courses for teachers and advisory inspectors were provided regularly for those schools involved.

The computers for teaching purposes chosen by ILEA for its schools was the Research Machines Limited (RML) product, 380Z in the beginning followed by the 480Z model at a later stage. Both of these were 8-bit machines with the latter having networking capability. Even in the early years floppy-discs were quite commonly used instead of cassettes and hard-discs had been later introduced for teaching purposes in secondary schools.

With technological advances, 16-bit microcomputers which had both larger RAM and much greater storage became cost-effective even to schools. At the same time there were available some powerful software packages designed originally for business use such as word-processing, spreadsheet, multi-plan, and database management systems.

A number of commercially produced software packages specially for school administration were available then in Britain, but these usually could run only on the BBC Micro or the 480-Z and not on new 16-bit machines. Such packages were usually aids to student data management such as the 'QAdmin', or aids to timetabling or subject options such as 'T-Square', 'Options', and 'Blockfit'. Also available were packages to allow a school to keep a full capitation account like the 'Capcon', or programs to keep simple library records such as the 'Tracer'.

Where schools had the expertise and interest, self-developed software for administration were also found. Such programs written by enthusiasts, however, were usually criticised for the lack of proper documentation, sometimes 'bug-ridden', and difficult to use except by the authors. Such software were confined in its marketability to other schools.

Of all packages, word-processing was perhaps the most widely acceptable one in the school office because of its simplicity and immediate usability. 'Word-Star' at that time was, for example, one of the popular word-processing packages for the 380-Z or 480-Z RML machines.

6.2 THE INNOVATION CHANGE PROCESS

Zaltman, Florio, and Sikorski (1977:53) have remarked that it has been widely acknowledged that most changes in education are externally generated (e.g. Stiles and Robinson 1973; Coleman 1973; Levin 1974; Carlson 1965) while others disagree with this position (e.g. Giles, Gatlin, and Cataldo 1974; see Section 3.2). Fullan (1991) simply accepts the fact that a number of major external and internal forces over time create pressures for change (ibid:17). He suggests that we do not even have to understand fully how these pressures specifically come about, because what interests him is the more specific manifestations of why people in education decide to push for or promote particular changes.

CAA in ILEA did not originate from the central education office, it originated in the schools. One could argue, though, that the use of computers in administration had become so common in the business sector that schools tried to follow but the evidence is circumstantial. Though the origin of an innovation may be of interest to some people, the writer is of the opinion that it is more fruitful to try to understand the interactions among the subsystems in connection with the innovation in order to manage it with a better chance of success.

The start of ILEA's CAA case could be traced back to September 1982. It was circumstantial then that a secondary school headteacher became surplus to establishment when his school was amalgamated with three others due to contraction. In ILEA then it was a matter of policy not to make its surplus staff redundant and so this headteacher Mr. PW, after consultation and negotiation, became CAA Advisory Head in September, 1982 -- a post which didn't exist before but created at his suggestion and left to him to develop.

As a headteacher, PW had experienced the burden of routine administrative and paper work like other heads. He was not a computer expert and had only little experience in using computers before in his school. His first acquaintance with computers was in a course organised by the MEP on the use of the machine in teaching. The course lasted ten weeks starting January 1981 after which he came to realise the potential of the computer in school management and administration. PW was interested in this area because he saw a gap between the use of County Hall GLC mainframe computers in administration and that of microcomputers only in teaching within schools. There was a vacuum for microcomputers in school administration, something which the term of reference in the MEP strategy did not include. Though with little formal training in computers, PW had the belief that computing has great potential as a management tool at all levels of the education system.

The official brief to PW upon appointment as CAA Advisory Head in September 1982 was:

- "(i) Categorising of current developments in administrative computing in schools, FHE establishments and AEIs.
- (ii) Summarising and collating data about the developments for consideration of their wider dissemination.
- (iii) Suggestions of further areas in which computer application could be made in the administration of schools (etc.) -- and co-ordination of pilot projects in such areas.
- (iv) Co-ordination of administrative computing in schools etc. with the organisational and curricular aims of the establishments."

After his appointment as advisory head for computer-aided administration, various inspectors and officers had referred other matters to PW when there seemed no obvious alternative location for those matters. As a result, PW regarded his brief as unofficially extended to include administrative applications of computing in Teachers' Centres, Libraries, Youth Centres and the Careers Service, at least in the sense that he could draw attention to the lack of support for CAA in these areas.

The original attempt by ILEA to explore CAA was thus deliberate at least to some extent, with the intention to seek improvement in the administration of individual educational establishments, secondary schools in particular, using computer technology. Central authority support for the innovation, however, was rather weak in the beginning, as could be seen from the comments made by PW in his *First Report on CAA* of January 1983. He remarked that he had no staff or other resources, save as a 'resident' at ILECC. PW reported fairly regularly to the Divisional Inspector (General), and, through him, to the Senior Staff Inspector (Secondary). He was not constrained by anything other than the brief described earlier, and had received no policy framework or document within which to work. His existence did not seem widely known in ILEA, nor his role understood, even in apparently relevant quarters. In his words, PW remarked then as follows,

"This is not offered as a criticism but rather as an important factor when considering how the Authority might develop its policy in this field. Put another way, the wide brief would, on the face of things, seem to sit uncomfortably with my formal chain of command. That this has not inhibited my work is a function both of the latter's exploratory nature at this stage and of the flexibility and co-operation of a host of people in different sections of the Authority. However it is probably time that such ad hoc arrangements were replaced by more permanent structures." (First Report on CAA, 1983)

The choice by PW to be based in ILECC for his work was a rational one for he was amongst a group of computer advisors where informal help and support he needed was available. In addition, he was successful in securing a desk in the ACU office after its establishment in 1984, where he could also be in touch constantly with the officers' side. This paved the way for the final structural changes which came about later when CAA became formalised.

After the appointment of PW as the CAA advisory head, he spent the initial five months in fact-finding and information gathering. He was trying to answer the question of "Where are we?" in respect of CAA in ILEA and in other LEAs. He used general ways of collecting information by doing a simple postal survey of all ILEA secondary heads asking for those administrative fields in which their schools were using the microcomputer and for those fields in which they thought the

microcomputer might be useful. He had reviewed literature including GLC/ILEA papers and works of writers in the field of CAA. Contacts were also built up with GLC/ILEA branches, sections and educational institutions. He also made visits to other LEAs with experience and interest in CAA, including Durham, Birmingham, and SCAMP (School Computerised Administration & Management Project) in Scotland. The concentration of all these activities was on CAA in the secondary school sector which was the first target group chosen on his own initiative by the advisory head, leaving other branches or sections to a later stage.

Alongside the gathering of information, PW also offered familiarisation courses in CAA for senior administration staff of schools in ILEA. The four-fold subscription to such 30-place half-day courses by senior administration staff and school secretaries indicated the scale of interest which could be anticipated from the future clients in the innovation. The other major objective of such courses was the diffusion of awareness or popularization of the innovation. This was the strategy used by PW from his date of appointment through to the time of study, and carried a flavour of the 'Normative-Re-educative' approach (see Section 3.7).

With the information gathered, PW identified a number of problems related to CAA. Over the country as well as in ILEA, CAA was growing rapidly but in a patchy, haphazard, and wasteful manner in different institutions (Watts, 1985). Most of the activities shown by the schools was based on self-developed programs (often 're-invented wheels') and as such were inevitably amateur, ad hoc, not easily generalised, poorly documented, bug-ridden, and unintegrated as PW described them. There was no co-ordinating agency who had a clear policy in mind and institutions and branches were thus operating largely in isolation lacking co-ordination in their CAA ventures. In the opinion of PW, the interest shown and activities then happening in schools, various branches and sectors in ILEA on CAA had reached the stage where the Authority would find it quite impossible to react negatively (i.e. with no policy initiative) to the impact of information technology on its subsystems.

PW saw only three possible alternatives for ILEA to respond to CAA -- indifferently, supportively, or interventionally. His recommendation was that ILEA's response should be first coherently supportive and then interventional (CAA First Report, January, 1983). Several needs were identified by PW for ILEA to carry the innovation forward. First was the demand for a clear policy decision on CAA. Second was the need for the development of a structure and strategy to execute the policy. Third was the need for funding and careful implementation. Finally was the writing of CAA specifications. Evaluation was not noted as an essential component at this time.

Subsequent to the First CAA Report in 1983 a pilot project was set up in ILEA under the direction of a CAA Steering Group which was chaired by the Deputy Education Officer (Schools). This indicated at least a partial commitment of ILEA to CAA and represented some achievement of PW's effort (see Section 6.3). According to PW, other members in the Steering Group consisted of representative selected from various branches on the grounds that some of the data used in schools was of interest to them -- Accounts, Security, Establishment, Organisation and Method (O&M), the GLC's Central Computer Services (CCS), Schools Branch, the Staff Side, Divisional Officers, Inspectorate, R&S, and later the ACU.

The pilot project involved a sixth-form centre and six other schools for a period of two years from 1983 to 1985. From the Final CAA Report (Watts, 1985), a number of points could be extracted about this pilot. Its objectives were to identify how CAA could be made useful to schools and to establish the best means of achieving this. It was a measure to make best use of available expertise and resources, co-ordinate experience and avoid unnecessary duplication of effort in schools or incompatibility of hardware and software. To achieve these objectives the Steering Group decided to provide central support only to the pilot, and other schools were meanwhile strongly discouraged by it from acquiring their own different hardware or developing their own software for CAA. Schools were recommended to acquire a grounding in the use of micros for administration using their existing facilities, on condition that they did not 'rob teaching' (as PW put it), i.e. deprive classroom teaching of computer resources.

These policies on CAA adopted by the Steering Group reflected the climate at the time of concentrating the use of computers only to teaching. There was a lack of the vision to seek new dimensions in effective school management by using computerised information systems. It was rational, in terms of saving of resources, to discourage schools from acquiring their own hardware or developing their own software for CAA to avoid incompatibility or duplication of effort. However, the opportunity cost was that such policies created barriers to future change of the schools in CAA. The loss of learning opportunities in CAA by the majority of schools for two years awaiting the pilot development was hard to estimate. With hindsight particularly after the 1988 Education Act and LMS (Local Management of Schools) in the U.K., when information management with computers had been recognised as a crucial element in schools, the writer is of the opinion that such an opportunity loss was rather heavy. This line of thought has an important bearing in Section 8.1 where implications for CAA in Hong Kong is discussed as the new SMI (School Management Initiative, 1991) policy is being implemented currently in Hong Kong.

Two significant emerging objectives were identifiable at this stage of the ILEA CAA innovation. First was the need for standardisation in CAA where appropriate for all secondary schools in ILEA. Second was the perspective for the design of an integrated CAA system. These were the criteria, as PW explained, necessary to achieve mutual benefits both to the central education authority as well as to the schools, with the long-term aim to set up a communication link between computers at the central authority and the microcomputers in the schools.

The approach in the pilot project was that each participating school was free to start from where it was in terms of hardware and software, tasks, and personnel involved. The Steering Group had deliberately chosen not to be prescriptive and the pilot schools were simply allowed to explore in their own ways. Consequently hardware from six firms was used and software was similarly varied. According to PW's Final CAA Report (Nov, 1985), "The objective (of the pilot) was to see what common ground could be reached on the requirements for the successful introduction of CAA to all secondary schools in ILEA".

The authorised budget for the pilot project was 30,000 sterling pounds, about three-quarters of which was spent on salary for a programmer/analyst appointed by the Steering Group for the two year life of the project. The ILEA CAA Project Team since then consisted of the advisory head and the programmer. The remaining portion of money was mainly used for buying CAA equipment made available to the pilot schools on a loan basis. Hardware installation and maintenance were supported by individual suppliers to schools. This small-scale financial support to the pilot project, in the writer's view, reflected to some extent the lack of priority given to CAA by the senior decision-makers in the education authority of ILEA at the time.

A library of about two dozen CAA 'stand-alone' programs was available for inspection by all schools (including those which are not in the pilot) but only about half a dozen of these could be provided with support from the CAA Project Team. These included, for example, TXED, Wordstar, SCAN, a Timetable Editor and Curriculum Analysis Program, and dBASE II, and a package for handling examination results. Consultancy and discussion of problems and possibilities were given by occasional visits to schools by the CAA team, educational computing advisors acting unofficially, staff from O&M and from the ACU (after its establishment in 1984). Other than regular training courses on CAA organised by PW the advisory head for schools in general, pilot schools had to train their own staff for their specific school-based applications.

In view of the limited support from the central authority, individual pilot schools sought their own support in various ways. For instance, the Sixth Form Centre had a full-time Administration Computer Technician; and one school received professional support from a commercial software firm who later expressed a desire for a joint exercise with ILEA in developing an integrated CAA software package which might be applicable to all secondary schools across the Authority.

An initial survey by O&M (Organisation & Methods Branch) on CAA in the pilot schools was carried out between October and November 1983. This survey was

intended to contribute to the Steering Group's understanding of the pattern of work in the pilot schools, to help identify aspects of school office work which seemed suitable for computer assistance, and to assess the likely impact in the school office of this new technology. Noting that attention hitherto had tended to centre around professionally-oriented administrative tasks, the O&M had concentrated this survey on the work of the office staff to try to ensure that the appropriate balance was achieved in computer developments. From the writer's point of view, this was an innovative move attending to the needs of a relevant subsystem (see Section 6.6.1).

After the pilot CAA project launch, PW requested in 1984 the Steering Group to set up an ad hoc committee for Co-ordination of Educational and Administrative Computing (CEAC). This was formed and chaired also by the Deputy Education Officer. PW was then asked by CEAC to submit a contingent proposal for part-funding by ILEA to one hundred and twenty comprehensive schools in the education authority for implementing CAA in 1985. This contingent proposal for a budget of 185,000 sterling pounds for CAA was tabled on 7th June, 1984 for the Steering Group. An alternative appended to this proposal on 18th June, 1984 was to pre-empt the Pilot Project recommendations in part by recommending a full, integrated and mandatory package for every ILEA secondary school, to be implemented by September 1985 -- incurring a budget of 1.3 million pounds. The budget proposal of the CAA Steering Group was included for discussion in 1984 by the Budget Committee of ILEA and the first recommendation was approved with a slight reduction. A provision was made for 150,000 sterling pounds for CAA (instead of 185,000 pounds) in the ILEA Budget Plans 1985-1986. But eventually in 1985 the budget plans were revised because of overall central financial constraints and the CAA budget was chopped. This again reflected the low priority for CAA compared with other educational spendings in the minds of the top decision-makers then in ILEA.

There were several reasons behind this contingent proposal by the CAA Steering Group during the piloting period. As extracted from the budget proposals, one supporting argument was that financial difficulty at the time and increased

accountability from ILEA schools had been demanding more and better information from schools without extra staff support. A possible solution to this problem was to use CAA in schools to help achieve greater efficiency and manage better information with existing staff. CAA was promoted by PW the advisory head, as a problem-solving strategy in response to pressures from the environment. In the light of Hargreave's Report *Improving Secondary Schools* (Hargreaves, 1984), PW argued, and the implementation of project INDEX (Innovation Development Exchange) in the ILEA, it was opportune to install CAA in schools. Project INDEX foresaw the eventual on-line enquiry with computers by schools, Teachers' Centres, Inspectors, and other educational users. Moreover, subject areas were then developing Graded Assessment schemes for schools in ILEA and some of these would be so large and complex that use of microcomputers in subject departments in schools would soon be necessary. Links using computers between school office, Examination Boards and possibly R&S branch were thus also envisaged. Moreover, the DES had approved an ILEA bid for a project on Profiles of Achievement which was a comprehensive scheme for monitoring and recording the achievements of secondary pupils. Half of ILEA's schools it was envisaged would be involved in this project, using computers linking to the R&S.

The previous paragraph described factors used by PW to support the contingent proposal to accelerate CAA implementation in ILEA schools during the piloting period reflected an interesting point. Different subsystems in ILEA were then competing for resources. There was no central policy on the use of educational computing technology and no holistic view in ILEA on the issue. There was a competition for limited resources among different changes advocated by different change agents. Advocators of different innovations, like the INDEX, the Graded Assessment Schemes, the Project on Profiles of Achievement, and others, were all participants on the one hand and competitors on the other in the CAA innovation. Each party was a change agent in a sense and each was bringing a solution to educational problems (both common or individual ones) which each of them had identified. Solution givers, using Havelock's (1970) term, naturally will try to justify and make a case for what they propose. In the writer's view, whether an innovation

gets adopted or not depends to a very great extent on how well the change agent can do this part of the job within the whole change process. It took three and a half years for PW the CAA advisory head to justify his case in ILEA.

A discussion of ILEA's CAA innovation with reference to Havelock's (1970) "Social-interaction" model and "Problem-solving" model (see Section 3.6.2) is relevant at this point. According to the social-interaction model, a basic assumption of the existence of research and development with a finished usable innovative product is assumed. This prerequisite of the model invalidates its direct relevance to the ILEA CAA case. However, its implication of the existence of loose social interactions among individuals or interested parties had been reflected in the ILEA case by the contacts which PW had made with other LEA's, and with professional bodies like CET, EMIE, BCS, etc. Moreover, such social interactions took place not necessarily at the dissemination stage after an innovative product was developed. They could happen at any stage of the change, as early as at the stage of initiation of the innovative idea.

The focus in Havelock's (1970) "Problem-solving" model centres on the user organisation and assumes that the organisation takes an initiation of the change cycle beginning with the first stage of a felt need for change. The cause for such initiation can come either from within the organisation or without. And, if at any stage of the cycle, an external consultant or change agent is called in by the organisation for help or service, the model becomes extended to the 'linkage' model (Havelock, 1970). From this perspective, it is the organisation itself that takes a central role in initiating the problem-solving mode (with or without the aid of external change agents), and actively seeks to identify both internal and external resources and solutions after a problem diagnosis. Havelock (1970:6) distinguishes three primary roles of the change agent in the problem-solving model: a catalyst, a solution giver, and a process helper. In the ILEA CAA case, PW the advisory head performed both roles as a catalyst and a solution giver. The case should also be looked at with a wider systems perspective in mind rather than with a narrow focus on a single organisation. PW could be considered as an internal agent within the ILEA system, irrespective of how he was

appointed and how much authority he was delegated. Disturbance to the status quo of the system began after his appointment and a felt need to change was slowly generated within the system. Diagnosis and expression of the need for CAA were articulated as a problem focused originally on the user sub-systems of schools but enlarged in the end to cover the whole ILEA system. The original problem and issues of schools using computers in administration became the authority-wide need for centralisation and standardisation.

As a solution giver, PW had consistently advocated the benefits of CAA to schools, ILEA branches, and to the central education authority. For schools, the problem was an increasing demand of accountability and thus more and better information but without extra staff added due to financial difficulty. CAA was offered as a possible solution by PW, in providing quality and quantity of information with greater efficiency from existing staff. Some schools had already experienced the benefits of CAA and the trend then was that more would follow as CAA proved its worth. This in turn created a need for ILEA to react. The only rational solution for the Authority was to take responsibility and leadership if it did not want to see CAA developing in its sub-systems in a chaotic, wasteful, and potentially in an out of control manner.

The third role in Havelock's (1970) model that a change agent can take, i.e. as the process helper, and probably the most important role according to Havelock, is to help the organisation (or client system) to develop its own problem-solving techniques. With the help of the change agent, the organisation is expected to build up its own problem-solving mechanism to tackle the various stages in problem-solving (see Havelock, 1970 for details). The pre-requisite of this approach is that the client system has accepted a 'self-renewal' philosophy and wants to become a problem-solving system. Rather than attending to ad hoc problems as they arise, there is a built-in problem-solving mechanism (or sub-system) within the organisation or the system to pro-actively identify problems among various sub-systems and solve them coherently. As far as the researcher could observe, there was no such holistic problem-solving mechanism within the ILEA.

As the interim proposal in 1985 to speed up CAA in ILEA secondary schools was aborted, the pilot project went on as planned. The wealth of experiences and lessons learned from the pilot project were collated in the evaluation reports submitted by each pilot school to the central support team in September 1985. To get some uniformity of approach in assessing the project and to ensure that all the important areas of concern were addressed in each case, a set of evaluation guidelines were prepared by the Steering Group for the schools to follow. Evaluations from branches, including O&M and a Divisional Office, were also invited. Major findings and implications were summed up by PW the advisory head in his Final CAA Report (November, 1985). A number of factors (both barriers and supporters) for the CAA innovation derived from this report are grouped under the different natures of resource, training, people, and technology for the discussion following.

Lack of resource was a primary problem pointed out. One school specifically mentioned the need for a cash injection from central authority to fully implement CAA. And because of limited resource in the central CAA team, pilot schools reflected that the progress made with training had been disappointing. One school invested 5,000 sterling pounds on CAA but the deputy head in charge of the system left and no one could succeed in operating it. The constraint of resource resulted in training limited only to a chosen few, and staff turnover subsequently hampered the continuity of the innovation severely.

Because the CAA innovation had implications for some possible organisational changes in schools and branches within the ILEA (a major point in Leavitt et al.'s (1973) framework which the writer described in Section 6.5.3), there were uncertainties and fears of CAA across the Authority. Although these psychological people factors seemed to have diminished during the life of the pilot project, they were undoubtedly still significant at the end of it from evidence provided by the schools and PW.

On the technical side of the innovation, it was found difficult to judge a software until it was tried in the working environment. Also, some schools over-

concerned about physical security requirements of the CAA system had limited the access by staffs. This indicated to some extent the lack of knowledge and understanding on the part of some school heads who treasured the computers and had them safely guarded in their office.

On the brighter side of the picture, pilot schools feedbacked a number of positive things about the CAA innovation. Following are some quotations extracted from PW's Final CAA Report (Nov, 1985):

"It is a fundamental part of our administration and more tasks are being computerised";

"It has proved a great success ... after seven months in operation ... a great improvement on the manual method";

"Exam work has proved mammoth ... a godsend";

"Now used almost continuously every day ... a second computer considered";

"Our expenditure .. & expansion ... indicate our conviction";

"Measurably more efficient, more effective, more accurate and less time consuming";

"Integration ... now convinced ... created demand for applications which we would not at first have thought of";

"Been able to take on administrative tasks previously carried out by teaching staff";

"Believes now that at least one day a week of the time of a senior teacher would be released from routine administration and become available for the classroom or other professional activities such as staff development of Heads of Department".

It was thus generally recognised by the pilot schools during the evaluation at the time that "CAA was more efficient, more effective, more accurate and less time consuming over the manual method in administrative work." (CAA Final Report, 1985). One school commented, most correctly in the opinion of the writer, that in the early stages there was not always be time saving but the quality of work improved. Time and effort need to be invested during the transition learning period

of the innovation (see Section 3.11.2) before benefits can be reaped. In addition, it can be seen from the above-quoted comments that the users have learnt, during the process of the innovation, to be more creative - in identifying more tasks to be computerised as well as the need for integration.

The recommendations after the pilot project coincided with the objectives which it was set up to achieve, with additional points perhaps gained from the experience in the two-year life of the project. First and foremost, ILEA was recommended to go for standardisation on both hardware and software in CAA. Second, it should aim for an authority-wide fully integrated secondary school CAA system. Such a system should be integrated with other administrative computing in other branches within ILEA and a communications network should be set up. In other words, a systems perspective including both the central authority and the school was held such that both could benefit from CAA. In view of these recommendations, there was thus the need to establish a central computing policy and strategy with central financial support for CAA. A structural change was also recommended to establish a new CAA Development Group to replace the previous ad hoc Project Steering Group and to guide a new central support team.

6.3 CAA POLICY DEVELOPMENT IN ILEA

In contrast to the classical Research-Development-Dissemination model (see Section 3.6.2), the popularisation stage of CAA in ILEA did not follow chronologically the pilot experimental stage but went in parallel. Gaining popularity and regularly informing potential clients about what was happening is an important aspect in innovation. Information helps to clear away uncertainties, and fear of the unknown on the part of affected people can be replaced by confidence and support for the change as explained in Section 3.11.3. The researcher could observe that this strategy was effectively applied by the CAA advisory head since his appointment. The tactics PW used to gather support from potential CAA users was by raising their awareness about the innovation, by providing them with information and basic

training in the technology. He thus offered awareness training courses on CAA open to all secondary schools, the target being heads and senior administrative staff, including school secretaries. Similar courses for Advisory Inspectors were offered. He also made use of regularly circulated Secondary Computing Newsletters (published by ILECC for schools on curriculum matters) by including articles about latest developments in CAA. Information about CAA was thus disseminated to all staff interested in this area in schools. For the special target group of school headteachers, who were key persons in decision about adoption or rejection of the innovation, a 'CAA Termly Report' was provided in every school term. Three Annual CAA Reports, issued respectively in January 1983, January 1984, and November 1985 reviewed comprehensively the CAA developments in ILEA for all parties concerned - including the Steering Group, different branches, and schools.

Furthermore, PW was always ready to receive feedback from or give support and advice over the telephone to schools as well as other sectors such as Teachers' Centres. The learning attitude of the advisory head himself was a notable and important feature to innovation management as the researcher had appreciated (see also Section 3.11.2 on Change & Learning).

With a blend of the empirical-rational and normative-re-educative approach (see Section 3.7), messages on the benefits which CAA could bring to schools were propagated through the above-mentioned channels. PW tried his best to make relevant subsystems (see Section 6.6.1) aware of and understand what benefits the CAA innovation could bring as an improvement over existing manual practices in school administration. Such objectives for CAA included, firstly, efficient use of office staff -- the constant minor changes to roll, groupings, booklets, standard letters not only cost time but also open the door to error; CAA would ease both. Second, provision for teachers of quicker and more reliable general information -- subsequently promoting greater efficiency on their part, both directly and, indirectly, by creating an ethos of efficiency. Third, removal of repetitive tasks from teachers allows fuller use of their professional expertise in appropriate ways. Fourth, planning and decision-making in schools would be enhanced by quicker and more reliable

information. Fifth, the demand for monitoring school performance (and thus the need for more statistical analyses) was increasing at institution, LEA and DES level, and this had put on ever greater demands on schools which were already experiencing considerable strain -- CAA offered a possible solution. Last but not the least, from an educational point of view, it would be self-defeating of the purpose to promote computer awareness in the classroom alone if students did not see teachers and staff using computers in their day to day work at school. It may be remarked here that rarely within the field of educational change could one find a case like CAA that might, if properly planned and implemented, benefit such a wide range of people -- from administrators, teachers, office staff, to pupils.

CAA in ILEA gained popularity in educational institutions partly as a result of the above-described strategy and also because of the wide-spread penetration of personal microcomputers into the society. To PW the advisory head, it had become more a question of why the computer was not in the school office than why it should be there. Getting this message across to schools in ILEA was easier, comparatively speaking, than getting it to people at the top who were the policy and decision makers. The advisory head, being in the middle, had to work in both directions.

The uncertainty within which the CAA innovation had been going on between September 1982 and the time of study, as the writer could observe, was due to two major constraints. The first was a lack of central policy and commitment; and the second was a lack of financial support. PW made much effort in trying to break through these constraints since his appointment as the advisory head, and he worked through both the formal and the informal channels within ILEA.

There being a clear distinction in ILEA at the time (according to PW) between the officer side as administrators and the advisory side as advisors, thus PW could only in an indirect way influence the making of decisions. The usual channel of upward communication was through reports by the officers to the Education Committee, with recommendations from the advisory incorporated where appropriate according to the conception of the officers. During the course of his work, there

were occasions noted by the researcher where PW managed to by-pass the junior officers and solicited support from senior officers directly.

PW was asked by the researcher to identify the key persons involved in the CAA innovation and he cited a number of people. First was the Senior Staff Inspector (Staff Development) who agreed to the terms of reference when PW was appointed as CAA advisory head. The second person was the Staff Inspector (Computing) in charge of the computing curriculum who had agreed and arranged for PW to be based at ILECC. PW chose to set up his work place within this infra-structure, as he explained, to be among a group of computer advisors and officers where he could get the support and knowledge he wanted and needed. The entry into the world of the officers was therefore conscious and purposeful on his part. The third key person whom PW solicited support from was the Head of Accounting of ILEA, who chaired the Departmental Computer Steering Committee on finance matters. This person helped to pave the way for PW to reach into the officers' group in ILEA up to the senior level of the Deputy Education Officer (Schools) -- the key person whom PW managed to get as the chairman of the CEAC Pilot Project for CAA. It was with the support of this DEO (Schools), the most important person to PW, that a budget of 185,000 sterling pounds was once proposed contingently in June 1984 during the piloting period for every school to have a computer system for CAA. However, that contingent proposal was turned down at that time because of a tightening of funds in educational projects and that CAA was a bit pre-mature then. This key supporter of the innovation was lost, however, when he left to become Education Officer in another LEA in 1984. He could not stay long enough to see the CAA Pilot Project through and PW told the writer that he missed him much.

In any case, the setting up of the Pilot Project could be seen as an outcome of PW's working through the informal machinery up to people (the DEO) who had the power to influence or make decisions. The Pilot Project represented at least a partial commitment from ILEA to CAA, and was some achievement of the 'political' efforts on the part of PW. The need for sponsorship in change, an important

criterion for success explained in Section 3.11.5, was well recognised by PW and manifested by his tactics through the informal process besides the formal channels.

Awareness of the significance and impact of the CAA innovation finally reached the top decision-making level in ILEA in February 1986, both through the formal and the informal channels. Through the formal channel, a report on 'Administrative Computing in Secondary Schools' (dated 13.02.86 by Education Officer, EO/ACU/5704) had been submitted to the Staff & General Sub-Committee, Development Sub-Committee, and Schools Sub-Committee. With the provision of 100,000 pounds made in the approved prescribed expenditure programme for the financial year 1986/87, this report served to seek approval for the detailed proposals outlined for the introduction and use of microcomputers by secondary schools for administrative purposes.

Chiefly based on PW's Final CAA Report (Nov. 1985), the report 'Administrative Computing in Secondary Schools' (dated 13.02.86 by Education Officer, EO/ACU/5704) summed up a number of points: (1) Pilot Project Evaluation; (2) Recommended Computer System; (3) Scheme of Development; (4) Initial Stages of Implementation; (5) Support; (6) Data Protection Considerations; (7) Staffing Implications; (8) Staff Side Consultation; (9) Financial Implications; and (10) Equal Opportunities Considerations. This report to the usual sub-committees was "exceptionally" (as PW remarked) called for discussion by the Policy Committee of ILEA on 21 February, 1986. PW explained why the CAA issue could be "exceptionally" put on the agenda of the Policy Committee as the result of an informal process: *a deputy head of a comprehensive school (who had previously worked with PW and his project group in trialing some CAA applications) had connection in a political committee with the Chair of Finance in ILEA and had influenced this person on the Policy Committee. The Chair of Finance became aware of the CAA issue and the urgent need for a central policy.* When the members of the Policy Committee met on 21 February, 1986, they felt insufficiently informed, particularly in view of the subject matter and of the far-reaching implications of CAA, and a Members/Officers Working Party on CAA was established to look into

the matter. Headed by the Chair of Finance, this working party consisted of four Policy Members, 3 Officers, and PW the advisory head; with the Deputy Education Officer (Finance) leading the Officers. The Policy Committee members had several main concerns over CAA. "Why the delay of a two year pilot?" was their very first question. They also asked about the CAA uses and their priorities; they wondered if it would be difficult to standardise without central funds; and they were concerned about the structural as well as the financial implications. To a very large extent, these questions and concerns reflected the ineffective communication channels between the Policy Committee members (policy and decision makers) and people elsewhere in the system working on the CAA innovation.

The Working Party met subsequently on 3 March 1986 and, as a result, an outline of policy on CAA emerged finally in ILEA. This was reported by PW to all headteachers of comprehensive schools in his *Update Report - The CAA Proposal* (March, 1986) and some of the important aspects are quoted below:

- * "Misconceptions on both sides (i.e. schools and Members) were removed";
- * "The Members are anxious that you (Comprehensive Heads) should be made aware of their commitment to promoting CAA with some urgency";
- * "Strategies are outlined on (i) The Software (ii) The Offer (iii) Support (iv) Timing" .
(Update Report - The CAA Proposal, 1986)

The policy for standardisation and integration, with part-funding (i.e. the Authority paying half of the hardware and software costs, the school paying the rest) as a strategy, was adopted in ILEA. This could be described as being power-coercive to some extent, different from the normative-re-educative approach PW used during the popularisation stage by training and information provision.

The writer agrees with the need to use different strategies at different stages during an innovation process. Strategies of a rational-empirical and normative-re-educative nature are more appropriate during the initiation and popularisation phase, but a shift towards a power-coercive (political-administrative)

emphasis on reaching the implementation stage is unavoidable when standardisation is seen as appropriate for policy reasons.

It is appropriate at this point to reflect upon ILEA's CAA innovation using a change model proposed by Zaltman, Duncan, and Holbek (1973). These authors have suggested an organisational change model with a focus on internal changes within an organisation. This model posits two basic change phases, initiation and implementation, with each phase consisting of several substages:

- | | |
|------------------|---------------------------------------|
| Initiation - | 1. Knowledge-awareness |
| | 2. Attitude formation |
| | 3. Decision |
| Implementation - | 1. Initial implementation |
| | 2. Continued-sustained implementation |

The authors of this model recognize that a change process will not always follow this exact pattern but will vary according to the nature of the organisation and the particular innovation in question. They consider that the process is probably not linear, with a clear-cut beginning and end, but rather circular. Each new decision or outcome is likely to affect one or more of the previous outcomes or stages.

Although Zaltman et al.'s model (1973) is intended for analysing changes in an organisation, the writer finds that it also makes sense when extended to changes within a large system. The first three stages in this model can be used to describe the development which took place in the ILEA CAA case studied. At the end of the period of study, the innovation had reached the end of the initiation phase and implementation was about to begin. Even though a pilot project had been carried out for two years, it was more a strategy for attitude formation rather than initial implementation. It was a pilot for trialing out, and finally substantiating, the innovative CAA idea more than what might have been assumed a project for developing or test-running of software and hardware.

It is necessary, in the opinion of the writer, to elaborate on the stage of decision-making about an innovation. There is the need for a recognition of two decision-making systems: that of the administration (authority) and that of the user. The Policy Committee of ILEA, for example, was the decision-making body on the part of administration, and the schools in ILEA may be considered as the user decision-making system. Insufficient communication between these systems created a gap of understanding, thus arose the question of "Why the delay of a two year pilot?" on the part of the Policy Members when the CAA issue was presented (in February, 1986 as described earlier) to these traditional authority figures for approval at the legitimation stage. Lack of sufficient interaction between the two decision-making systems in the phases prior to legitimation is therefore unwise especially for major innovations.

Rogers and Shoemaker's (1971) "Authoritative/Participative Models" are also of relevance in the discussion here. These authors discern the approach to change in terms of the extent to which decisions are made by authority figures or by people who will implement and/or be affected by the innovation. In their "Authoritative approach", the importance of the superior-subordinate relation is stressed. The change process is divided into the two phases of decision-making and implementation. Decisions regarding acceptance or rejection of changes are handled by authority figures. Then follows the implementation phase with the decision communicated to adoption units which proceed to implement or reject the change. In the "Participative approach" of Rogers & Shoemaker (1971), however, the stress is on the subprocess of establishing consensus among members of the social system (those affected by the change and those in authority) to accept or reject the new idea.

The ILEA CAA case exhibited characteristics of both the "Authoritative" and the "Participative" approaches described above. It was participative and with consensus on CAA between the potential school users and the CAA Project Team, but not so with the authority figures. When the new idea was accepted by the Policy Members, an authoritative power-coercive strategy (using part-funding schemes to implement CAA in schools) was taken by ILEA in the implementation phase.

It is worth noting that neither of these approaches should be considered as intrinsically 'good' or 'bad'. The choice is very often not necessarily rational nor deliberate but depends on the nature of the innovation as well as on the stage reached in the process. Thus when it was realised in the ILEA CAA case that standardisation across the Authority was their need, an authoritative approach followed quite naturally. The major implication of the models discussed is therefore the importance of awareness to individual decision makers. From what has been found in the ILEA CAA case, and with a systems perspective, awareness about an innovation should cover not only the decision-making systems within institutions, but also the decision-making system at the central authority.

6.4 CONCLUSIONS FROM ILEA'S CAA CASE

The case of ILEA's innovation of using computers in school administration has reviewed a number of features in two main areas. First there are findings which can contribute to the technological aspect of the CAA innovation (i.e. the specifics involved in computer-aided school administration); and second there are illuminations to the process of managing an educational innovation.

On the technological side of the CAA innovation, which is a trend in the modern society, ILEA's case reviewed that there are benefits to be gained from CAA by different parties of an education system (LEA's as well as schools). Maximum benefits, however, can be obtained only with a holistic systems approach, i.e. by considering schools, central education offices, and related branches as sub-systems and taking an integrated approach. To achieve such an objective, it is necessary to have standardisation on both software and hardware, and there is the need to develop an integrated administration software system. Off-the shelf business software packages, with the exception perhaps of word-processing, can provide only limited benefits to schools compared with tailor-made integrated systems. Dedicated computers for administration with hard-disc storage and communication capabilities are required, rather than a sharing of computer usage with teaching and learning.

Thus central support in resource acquisition, training, technical support and development of software should be provided. There will be very likely a need for structural changes within the education system and the sub-systems when the innovation is done on a region-wide basis. Without a central policy, schools or individual institutions might or might not gain benefits from CAA, depending on the expertise (both in technology and in change management) found in individual organisations or support from professional software developers.

Concerning the process of an educational innovation, ILEA's CAA case is illuminative on a number of points. Undoubtedly, desire to change on the part of the system is a key factor in starting an innovation, as clearly spelled out in the working definitions of innovation reviewed from literature (see Chapter 3). But desire on whose part is often overlooked. It would be erroneous to assume that such desire is automatic for an entire system. In ILEA's case, the enthusiasm of PW the advisory head was significant but notably different from say policy-making people who had authority. Acceptance of an innovation by subsystems involved is something which has to be worked for. The desire to change usually begins with a subsystem which has become aware of a certain problem or a need to change. Depending on the position of this subsystem (the change agent subsystem) within the power structure of the system, the processes and strategies of the innovation which follow will vary. Through formal and informal channels of communication, knowledge and information about the innovative idea are disseminated amongst subsystems. The more thorough other relevant subsystems become aware of the problem and the need for change, the better the foundation for the innovation. The very first task of the change agent subsystem during the awareness stage of an innovation process should thus aim at achieving a desire to change on the part of the whole client system.

Attitude formation, according to Zaltman et al.(1977), is the second key stage following awareness in an innovation process. This is the stage, as these authors have said,

"sometimes referred to as mental evaluation or as liking (or disliking). The process involves a mental check on the innovation with regard to its relative advantage over other alternatives in solving problems, its compatibility with the individual sub-system's (extended from the original individual-oriented notion to a wider system perspective here) values and mode of operation, its degree of complexity with regard to use, its potential for trial on a small scale without full commitment, and its ability to demonstrate usefulness in problem solving." (Zaltman et al., 1977:65).

Looking back at ILEA's case, helping subsystems involved to formulate positive attitudes on CAA was one of PW's primary roles. During the stage of attitude formation, the change agent's task is to help achieve a commonly acceptable set of objective(s) with respect to the innovation for other involved subsystems. In reality, different subsystems will not always have a common goal -- a point often cited as the limitation of the systems approach -- but it is still practicable in the writer's view and as illustrated in ILEA's case, to arrive at a set of objectives which is 'satisficing' (in Simon & March's term). Commitment from the subsystems must be obtained if the innovation is to be successfully carried out to its sustained implementation stage.

Following attitude formation comes decision. This is the phase of the innovation process that involves some form of legitimation or policy formulation about the innovation. It is the phase where commitment to a set of objectives is crystallised out as a result of the previous two stages. Unless the case is one of an individual adopter deciding on his/her own part for private use, else this stage would involve in fact two sub-stages of (i) the sub-process of the new idea being approved or sanctioned by the decision-making sub-system which formally represent the social system in its norms and values and in the social power it possesses, which is commonly termed legitimation (Rogers and Shoemaker, 1971); and (ii) the subprocess of establishing consensus to accept or reject the new idea by other sub-systems. Legitimation is also the subprocess whereby resources are made available for the innovation -- either by a re-allocation of existing resources or the use of slack resources.

Thus in the ILEA CAA case, legitimation was initiated by the central authority but schools as sub-systems could still accept or reject the innovation. In turn, when considering a case of a single school as a system, legitimation by the school board or the head has to be complemented by the decision of the sub-systems of office and/or teaching staff. Neglect of the latter is one of the reasons why top-down innovations with an authoritative approach often fail (see Section 3.11).

Rogers & Agarwala-Rogers (1976) consider that the adoption decision stage is only the beginning of the innovation process, saying

"The first stage of the innovation process involves the matching of an organizational problem (a performance gap) with an innovation. This is essentially a decision that the potential innovation is, in fact, an appropriate possible solution to the problem. This decision may be made at different times in different parts of the organization; At some point an organizational decision is made to match the problem and the innovation with appropriate slack resources for adoption. At this point, we say that the actual process of innovation has begun (we do not consider the problem definition process to be a stage of the innovation process but rather a precondition for it; the fact that non-innovative outcomes also result from problem definition makes it misleading to tie the two processes into a unidirectional sequence)." (Rogers & Agarwala-Rogers, 1976:163).

Although Rogers & Rogers's (1976) discussion is focusing on organisations, it has relevance when broadened to a system-wide innovation. To these writers, an innovation process consists of an initiation stage which is "the process by which an organization becomes aware of an innovation and decides to adopt it" they call adoption (or matching). Then comes a number of implementation stages subsequently including "Testing", "Installation", and "Institutionalization". It is not intended here to argue about whether adoption is the beginning of an innovation or not, the concern of the writer in referring to Rogers & Rogers (1976) is the recognition of the significance of the initiation phase (through awareness and attitude formation to decision) during the innovation process -- the precondition as Rogers & Agarwala-Rogers (1976) put it, before the implementation phase can begin. It took ILEA three-and-a-half years in the case studied to get to this precondition, and a number of features could be identified during that period of the change process. In summary of what has been described in Sections 6.2 and 6.3, the key features of the initiation phase of ILEA's CAA innovation are recapitulated below.

During the "knowledge-awareness" stage, there was the perceiving by some individuals (PW in particular) of the performance gap of schools to external accountability. By comparing educational institutions, and their relative effectiveness, with business organisations which were using computer technology, the question of CAA emerged. A change agent subsystem -- the CAA advisory head -- was created which was rather ad hoc in the beginning but becoming increasingly influential after appointment. Then followed a search of information by this change agent subsystem, and CAA was finally offered as a solution to narrowing the initially perceived performance gap. In parallel with the information search was the period of popularisation for the innovation -- diffusion of knowledge and broadening of awareness about CAA amongst other subsystems using both the rational-empirical and the normative-re-educative strategies. This may be considered as a period of attitude formation when positive attitudes of other subsystems towards CAA evolved. Positive attitudes were, however, more difficult to shape on the part of the decision-making subsystem in the central authority (probably due to lack of efficient and effective communication channels) compared to potential school users. Then came a period of trialing for the innovative idea with the CAA pilot project. That piloting, however, was more a testing of the innovation idea than the trialing of an innovative 'product'. Both to the participating schools and the project team, it was a period of learning more about CAA and gaining experience with it in the field. It also paved the way to the decision-making stage when policy-makers in ILEA became aware of the significance of the CAA issue.

The whole initiation phase of ILEA's CAA innovation, in the writer's opinion, could also be considered as a 'policy formulation' process for the innovation. It should be noted that although the process moved in the general direction as summarised above, the stages in fact overlapped and cyclic subprocesses of "awareness - attitude formation - decision" occurred within each broad phase involving different subsystems. There were also changes in direction and objectives noticeable within these subprocesses as necessitated by the gaining of knowledge and identification of constraints at the time concerned. Thus, for instance, the original objective of providing a multi-user computer administration system in each ILEA

school was amended because of financial constraints to a 'satisficing' objective of a single-user system to begin with. Likewise the objective of using an integrated software system had become a longer-term aim than originally envisaged because of the lack of emphasis on software development over the initiation period of the innovation.

ILEA's CAA innovation reached the implementation stage when the study ended in March 1986. The immediate need for development of an integrated (or partially integrated to start with) administrative software system subsequently surfaced to top priority in the process of the innovation. In contrast to the attention given to the social aspects in the innovation over the few years of the initiation phase, the technical aspects received a much lighter share of effort and no formal research and development was done. The primary attention given by the CAA advisory head to the social-political aspect instead of the technical aspect of the innovation was understandable in view of the limited resources given him before ILEA formally committed itself to CAA.

6.5 ESTABLISHING A TENTATIVE MODEL FOR INNOVATION

In Chapter 3 a number of classical models of change have been discussed (Section 3.6). Such models, in the writer's opinion, serve an analytical purpose for studying an educational change more than the purpose of managing the change in practice. They belong to theories of change, not of changing, as explained in Section 3.10. And although in Section 3.11 the essentials of managing change under the current perspectives in the 1990's have been identified with the five main areas in connection with excellence, learning, people, culture, and leadership, there still remains the question of how to utilise such knowledge systematically in practice. In this section an attempt is made to fill this gap. From the literature examined and the work of the ILEA case study, the writer developed a tentative model for managing the CAA innovation process. This model was later used in the field work for a case school in Hong Kong the findings of which will be reported in Chapter 7.

It may be appropriate here also to reiterate the conceptual framework of the writer in using an "action approach" within a general systems perspective for changing (see Sections 2.0, 5.1.3, 6.5.2, & 6.6.11). A systems view is helpful in the understanding of what an educational innovation, as a whole, is about. The first few sections following attend to this aspect. The later sections address the process of carrying out an innovation according to the tentative model proposed.

6.5.1 INNOVATION AS A WHOLE

In the broadest sense, the writer considers any innovation to involve basically two phases: a phase of creation by a producer (or innovator); and a phase of utilisation by the user (or the client). The writer uses the term 'innovator' in a sense different from that of the 'change agent' or 'change facilitator'. While the innovator is involved with the task of creation or production of the new 'thing', the change agent is functionally different with the task of managing the change process. There is no argument that both roles may be taken up by the same person or group of persons but a distinction of the two different functions is necessary. In other words, it is important to recognise that producing an innovation is one thing, implementing it is another.

Moreover, the creation phase is not necessarily separated from the utilisation phase sequentially. User participation in evaluating and feeding back for improvement or modification during the development process is valuable in several aspects. The product developed will be of better quality, and what is more important, better accepted by the users. Besides, commitment generated by the involvement on the part of the users will also much facilitate the change process. The SCHOLIS project on CAA in the Netherlands (Visser, 1991) serves as a good illustration of this approach.

6.5.1.1 The Creation Phase

Included in the phase of creation of an innovation would be sub-stages as follows:

- (1) Perceiving a new idea or concept;
- (2) Transforming the idea into a 'product', possibly incurring research and development, as well as testing and trialing;
- (3) Outputting the product in a utilizable form.

These steps form the essential procedure for an innovation following the Research-Development-Dissemination model when the final step of disseminating the product to the user is added. Sometimes the step of evaluation is incorporated as well. However, leaving the innovation at this stage is obviously seen to be incomplete -- by leaving unanswered the question of whether the utilisation by the user is successful or not.

6.5.1.2 The Utilisation Phase

The utilisation phase of an innovation in this context is taken to mean both initiation and implementation of the innovation on the part of the user. Sub-stages in this phase would in general include:

- (1) Awareness;
- (2) Attitude formation;
- (3) Decision to adopt or reject;
- (4) Learning and trialing;
- (5) Routinised application.

The final stage of routinised application, or institutionalisation, of an innovation in fact marks the end of the change process. This is the stage when the innovation has become something no longer new to the user system, but something which has been incorporated by it as a matter of routine. When this stage is reached,

the innovation can be said to have been successfully implemented (sustained implementation), or institutionalised in the case of an organisation adopting the innovation.

Concisely, in the writer's opinion, the whole process of an educational innovation is the transition from its creation to utilisation.

6.5.2 A FOUR-SYSTEM FRAMEWORK OF INNOVATION

The previous description of stages in an innovation inevitably over-simplifies a very complex process, and the sequence of steps does not necessarily follow the order as listed. It is only illustrative of the kind of interactions involved amongst the systems concerned in a change. Writing about systems involved in a change, Bennis has the following to say,

"The process of planned change involves a change agent, a client system, and the collaborative attempt to apply valid knowledge to the client's problems" (Bennis, 1965, in Bartlett & Kayser (ed.), 1973:68).

Putting it in more concrete terms, Bolam (1974) describes the three major factors in the process of innovation over time as the change agent system, the user system, and the innovation system. Following the view that the systems and action frame of reference can be treated as complementary, Bolam conceptualises these three factors as "open systems but particular account is taken of the way in which individuals and groups within these systems construct their own phenomenological worlds and thus affect all aspects of the organisation, including its innovation activities." (Bolam, 1974:72)

An innovation system, in the simplest sense, is the new practice introduced deliberately for some intended benefit.

A change agent system can be a single individual like a school principal or teacher, or a team of people implementing the change. It can also be internal to the organisation, external to it, or a combination of both in terms of membership.

A user system can vary much indeed in size and scope. In the case of a country-wide or district-wide innovation, the user system would include a number of subsystems such as the central education authority, schools or educational institutions affected, the teaching force, perhaps parents and other interested parties too. When the user system is a single school, subsystems identifiable might include part or whole of the teaching staff, the school management board, office staff, administrative staff, and perhaps students and parents too. The user system, or client system, is therefore innovation-dependent -- not only on its nature and scope, but also on the stage reached in the innovation process.

One basic assumption common to the three-system framework of innovation according to Bennis or Bolam is that an innovation system is already in existence, that it has already been created or developed and is ready for utilization. A 'creating system', in other words, is arbitrarily left out and the concern is with the utilisation phase of the innovation. It may be true that many innovations are created external to the user system but a more comprehensive conceptual framework for innovation should include, in the writer's view, the 'creating system' as well.

To recapitulate, any innovation can be viewed as a framework consisting of four systems: the innovation system, the change agent system, the user system, and the creation system. Using CAA as an example, the four-system conceptual framework for an innovation can be illustrated as explained below.

In the case of a school using self-developed CAA software, for instance, the school can be considered to have incorporated all in one the creating system, change agent system, user system, and the innovation system. Within the school, it might be further identified that the creating system consists of a group of staff with the expertise for developing the software (the innovation system) for application. This group of staff, perhaps with the head added, might be acting as the change agent system to help the whole teaching staff (the user system) in the use of the CAA innovation system.

In the case of ILEA's CAA innovation in London studied in this thesis, the conceptual framework is equally applicable, though in a much more complex sense. The user system here includes not only individual schools each of which forms a subsystem, but also the central education authority as well. The CAA team led by the Advisory Head under the central education authority is the change agent system in two dimensions - towards the central office in effecting a central policy on the one hand and moving schools towards the computerisation trend on the other. The same team, in addition, is the creation team for the innovation system of CAA software, with an external software house linked up at the later stage to increase its development strength.

In the case of the school studied in this research, the user system is the school, the innovation system is on CAA, the creating system is a company that has developed the software package, and the change agent system includes the school's internal CAA group and the researcher as an external consultant.

It will be appreciated that a total innovation including both the creation stage and the utilisation stage is more complicated to manage than one that involves only adoption and application. Interactions between the creation system and the user system have to be taken care of preferably at an early stage of the innovation process whenever possible as demonstrated by the ILEA case. This prepares for a more solid foundation for success subsequently in the utilisation phase of the innovation by the user.

In many cases, innovations are created and developed external to the user system, the process of innovation then is primarily concerned with adoption and putting into practice, i.e. implementation in the broad sense. This is the situation for the school under study in this research and such will also be the emphasis in the discussion of the model and framework of innovation in the following sections.

6.5.3 TARGET OF CHANGE

Any aspect of the user system can be the focus of change in an innovation. In the case of innovations in a school, a useful taxonomy to help focus one's attention can be adapted from the systems view of Leavitt, Dill, and Eyring (1973:9). They consider that an organisation can be represented by four interacting subsystems namely structure, task, technology, and people as depicted below:

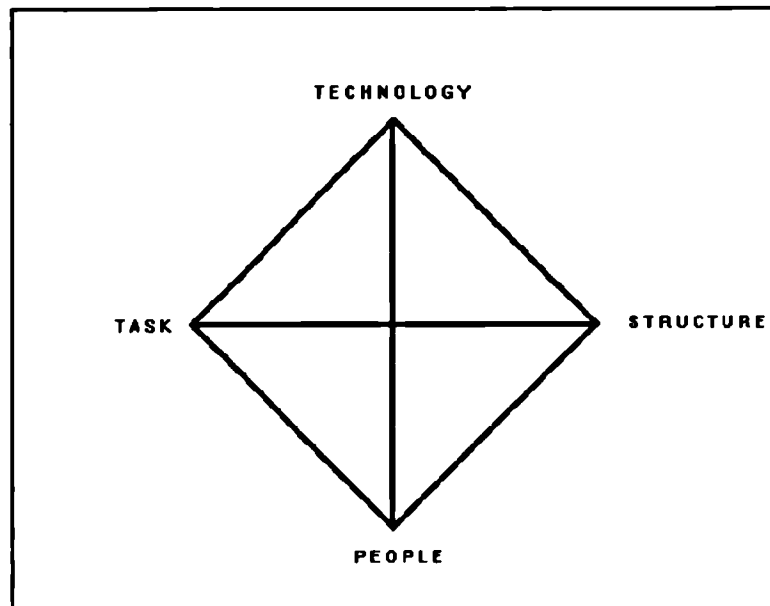


Figure 6.1 Four Subsystems of an Organisation

Any innovation system created would have as its primary target the objective of changing some aspects in one of the above subsystems in an organisation. The mutual dependency of these subsystems and their interactions within the organisation, however, would exclude the possibility of changing only the primary target without affecting the others.

Using CAA as an example of the innovation system and expanding on the above taxonomy, it is proposed to look at the innovation in the following manner by adapting Leavitt's framework as follows:

- (1) *The task-structure-technology-people representing the user organisation is put in a pyramidal form.*
- (2) *Since technology is the primary target of innovation in CAA, the pyramid is drawn with this subsystem at the apex. The other three subsystems form the base of the pyramid.*

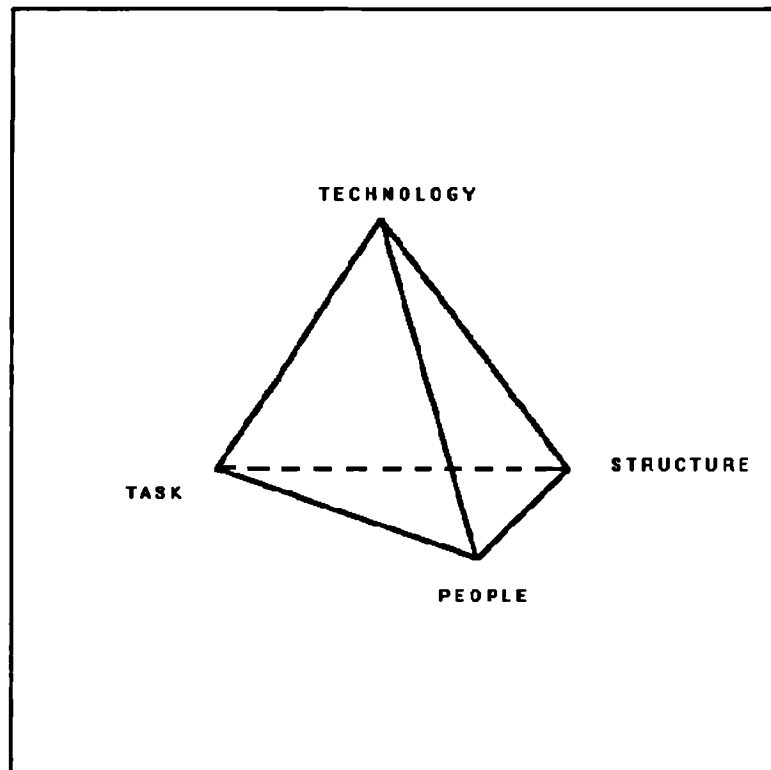


Figure 6.2 Target of Change & Organisational Subsystems

Such a three-dimensional figure not only indicates the interacting subsystems but also carries the meaning that an innovation on the primary target (the technology subsystem in this CAA example) requires a supportive base of the other three subsystems and relevant changes in them must be taken into account in the innovation process to achieve success.

For other innovations where the primary target of change may be any one of the subsystems of structure, task, or people, a similar pyramidal organisational diagram with a different apex can be drawn.

6.5.4 ILLUMINATIONS FROM THE ILEA CASE

In Chapter 5 on the design and methodology of this research, it was explained that a model of an innovation process would be generated from the grounded work of the ILEA observer case study in London together with literature reviewed, which would then form the basis of procedures to be followed by the researcher in the Hong Kong school case of CAA innovation. Such a model, however, is understandably primitive and modifications were expected when the researcher worked through the school case in Hong Kong. This is the reason for labelling this model as the 'tentative' one, in contrast to the 'revised' version which will be presented in the next chapter as part of the findings in this thesis.

The ILEA case provided an opportunity for the researcher to study an innovation process up to the stage of decision-making. A central policy was made to adopt CAA on an authority-wide basis for about one hundred and fifty secondary schools. This case study helped to identify several major points in an innovation process. First, two key phases of an innovation process are discernible -- the initiation phase and the implementation phase; the two being separated by the stage of decision to adopt the innovation. Second, during the initiation phase, all interested parties connected with the innovation have to go through sub-stages of awareness and attitude formation. This is a prerequisite for the innovation process to continue. These two sub-stages, however, are necessary but not sufficient conditions for successful implementation of innovations. Third, during the initiation phase, information exchange among interested parties should be the key strategy employed.

In the ILEA case, much work was done by its CAA team (the change agent system) during the period of initiation which lasted for three years, these included:

- (1) information gathering and updating itself (the change agent system) in knowledge and skills with CAA -- self-development;
- (2) disseminating CAA information to secondary schools in ILEA (potential user systems) through publications, training workshops, and seminars -- a 'managing-down' tactic;

- (3) disseminating CAA information to the central educational authority (decision-makers) as well as reflecting the needs of schools -- a 'managing-up' tactic;
- (4) trialing CAA on a small scale in a pilot school, and, with the support of a software house, experimented for a workable CAA solution -- use of external expertise.

The change agent system in this case had two user systems to attend to -- (i) the batch of secondary schools in ILEA and (ii) the ILEA Education Authority. On the one hand it had to help secondary schools become aware and supportive of the CAA idea by 'selling' to them the benefits of CAA; on the other it had to convince the central authority which was the policy decision-maker about the long-term benefits of the innovation. This dual role of the change agent system made its innovation tasks much more complex and political in the ILEA case when compared to the researcher's case in a single school in Hong Kong. However, a conceptual framework can be formulated from the ILEA case as a working basis for a change agent system during the initiation phase of an innovation basis. The following section explains details of a working model for the CAA innovation established as a result of the literature reviewed and illuminations gathered from the ILEA case.

6.6 A TENTATIVE MODEL FOR CAA INNOVATION

A working model of managing an innovation process established at this stage of the study is illustrated on the following page in Figure 6.3. Subsections 6.6.1 to 6.6.3 explain in detail the tentative model depicted.

To be of value to the practitioner, a model has to be unavoidably prescriptive in a sense, providing a kind of reference guide for the change agent system to follow in the process of putting the innovation system successfully into practice by the user system.

In this tentative model, an initiation phase precedes implementation. The sequence of steps during the innovation process follows a sequential order through the five stages of awareness, attitude formation, decision making, trial implementation, and sustained implementation. The feedback loops channelling among the four first stages indicate that these stages, although shown as discrete and sequential, are in fact 'interfering' with one another. For instance, trialing of an innovation will bring the level of awareness and understanding about the innovation to a different level compared to initial awareness about it. Different attitudes will also be formed as a result of trial which might affect decisions for subsequent actions.

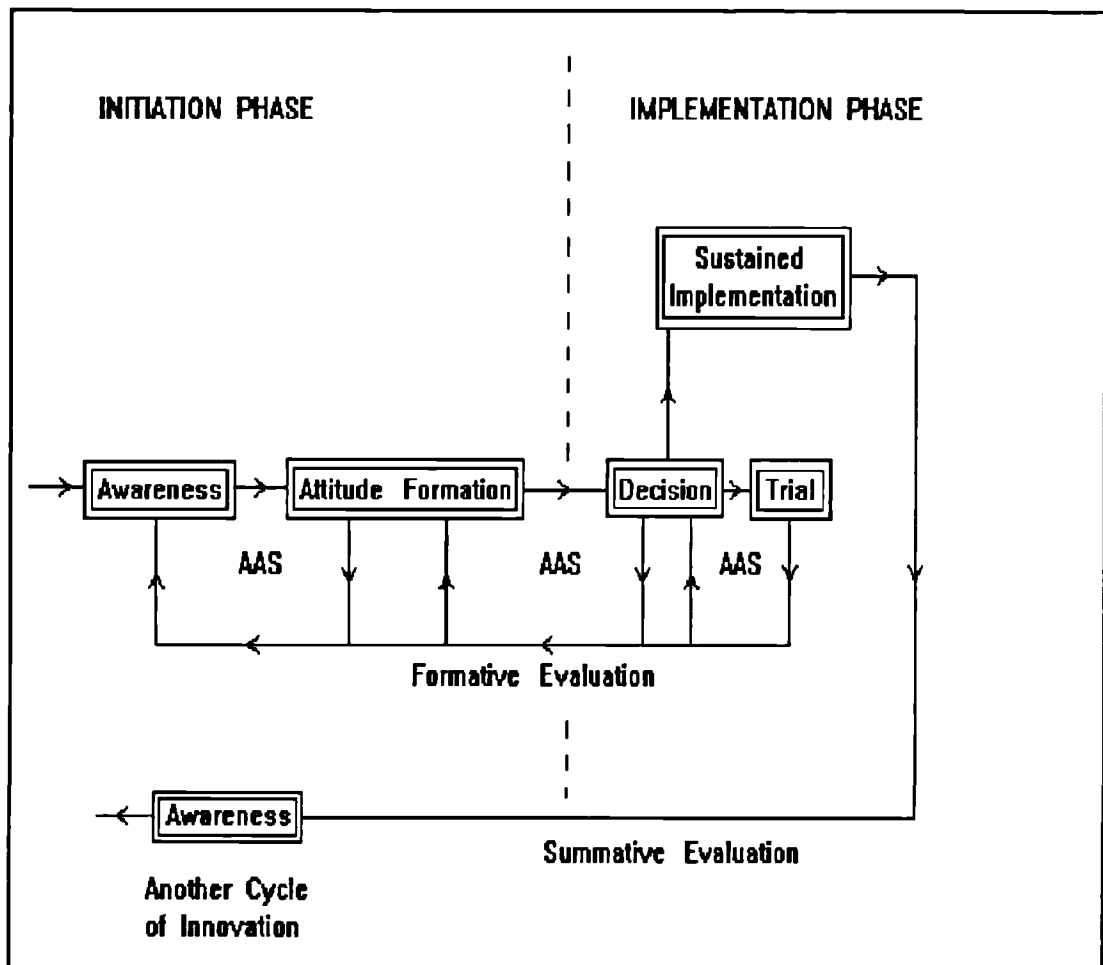


Figure 6.3 Tentative Model of An Innovation Process

6.6.1 THE INITIATION PHASE

The initiation phase is the transition from the state of knowing that an innovation exists to the state of making a decision of adoption (or rejection). During the initiation phase, the change agent should be working in a cyclic process involving awareness and attitudinal changes of actors concerned in the innovation. The key feature and approach during this phase should be one following the "action approach". The meaning of the innovation, for the actors concerned, i.e. teachers and clerical staff in the case of CAA in a school, is the working target of the change agent system.

To get to the stage of decision for adoption is the primary task before anything else can follow. In this regard, a change agent can consider taking the following strategies:

- Strategy 1: Defining the 'Relevant System in Focus' - RSF;
- Strategy 2: Searching and communicating information to raise level of awareness of RSF about the innovation;
- Strategy 3: Building common grounds of worth for the RSF.

Even for innovations at the individual institutional level, the user system is often consisting of a large number of subsystems. It is impractical for a change agent system to attempt to manage the entire user system as a single entity during the change process. Instead, it is more applicable to define a span of focus at a certain time for a certain situation (or phase) during the change process. In other words, the change-agent, with a 'dynamic systems view', is situational in defining the system boundary with relevance to the objective(s) at different phases. People identified as key persons at different stages form the 'Relevant System in Focus', i.e., the 'working system' isolated for attention by the change agent.

Any innovation will carry different meanings to different user subsystems. Dalin (1973) has pointed out that the question of whether an innovation is beneficial

or not depends on 'to whom?'. It is argued that successful implementation requires that relevant subsystems see some worth of the innovation from their stand point at this initiation phase of the change process, e.g. people see from the inception of CAA how useful it was to them. The major task of the change-agent is to help merge (or make overlaps as much as possible) the initial incongruent sets of goals brought into the user system by various actors. The key features involved in the initiation phase are repeated here for clarity.

(i) Defining the Working System:

- (1) Identifying all subsystems of relevance to the innovation - forming the total system.
- (2) Extract from the total system, at different stages of the change process, the 'Relevant System in Focus' - 'RSF'.
- (3) Situational expansion or contraction of RSF as guided by results of formative evaluation.

(ii) Action Approach Subroutine (AAS):

Between stages within the change process, a cyclic process of steps is taken:

1. Analysis of present situation;
2. Clarification of meanings within RSF;
3. Contraction or expansion of RSF if necessary;
4. Search and dissemination of needed information to reduce uncertainty;
5. Evaluation and selection of alternatives;
6. Solicit agreement on common set of objectives for next stage and commitment from RSF.

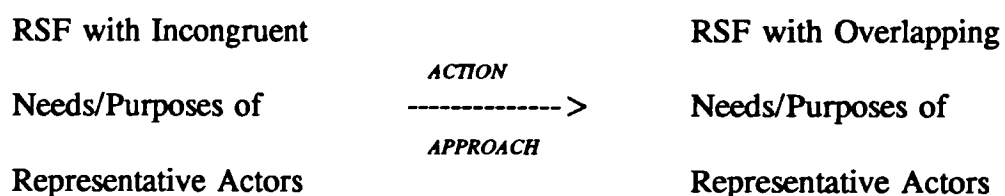


Figure 6.4 Merging of Innovation Goals

The term awareness used in this context includes information, knowledge, and understanding of the innovation system on the part of the RSF. Different levels of awareness will lead to different attitudes of the actors concerned, subsequently leading to adoption or rejection of the innovation, as well as different degrees of ownership of it. The role of the change agent system during the initiation phase is one of transmitting knowledge, raising concern, and communicating information among the working subsystems defined. The provision of information about the innovation system to the participants is particularly important at this stage. In more explicit terms, Hurst (1983:57) suggests that information about the innovation system to be communicated would include: relevance or desirability; effectiveness or reliability; feasibility; efficiency; trialability; and adaptability.

During the initiation phase, it can be said that the bias or concentration for the change agent system is, according to the typology of innovation factors (Section 3.5), more on knowledge than skills and support. For the implementation phase, however, the emphasis would be on skills training and support rather than basic knowledge about the innovation system.

For large and complicated innovations, adoption for practice is usually preceded by pilots or trials. This is a more secure way to step into the unknown, to face uncertainty, without risking too much. In case the impact of the innovation on the user system is found to be too undesirable or if the adaptation is too costly, the user system can still revert to its original state.

6.6.2 THE IMPLEMENTATION PHASE

Regarding curriculum innovations, three distinct perspectives that underlie the various attempts to explain the reasons for the gulf between planned intentions and subsequent outcomes have been pointed out by Morris (1987). These perspectives are (1) technical inefficiencies, (ii) power conflict, and (iii) neglect of implementation. Furthermore, two distinct strands are listed under the last perspective. As Morris has written,

"The first strand has viewed teachers and other innovation users as a reactionary and ultra conservative group who do not appreciate the benefits which will arise from an innovation. ... The other strand has emphasized that innovation users are reasonable decision makers who are willing to change but will only do so if they perceive the overall benefits of changing to be greater than the overall costs." (Morris, 1987: 52)

The writer shares the view that willingness on the part of potential innovation users is necessary and their perception of the overall benefits of changing is essential. This is what the initiation phase in an innovation process is all about. However, it is argued that willingness to change is one thing, whether the potential innovation users can or be able to do so is another. This last question is exactly what implementation should address. In other words, during the implementation phase of the innovation process, potential users need to be developed to become effective users of the innovation. Training and support for the parties concerned are the most crucial elements to overcome general feelings of insecurity and temporary incompetence during this period of uncertainty.

In the case of CAA, acquisition of technical skills and subsequent transfer to the workplace on the part of school staff is the prime objective of the implementation phase. In this regard, Joyce's (1986) approach in training teachers to learn a teaching repertoire has much to be borrowed. Quoting from this renowned trainer of teachers,

"The first step is to teach everyone involved in training about the problem of transfer and what they can do to overcome it. ... Teacher trainees must be mentally and emotionally prepared to engage in the practice necessary to permit new learning to take place. ... The teacher must accept responsibility for the struggle to achieve transfer. ... They (the teachers) forecast the problem for themselves and consciously push themselves through the period of discomfort, deliberately altering customary patterns to accommodate the new skills and viewing the dislocation of familiar skills as a challenge to be overcome." (Joyce & Weil, 1986:478)

A major part of the approach of Joyce & Weil is the development of a high degree of skill by thorough training in an adequate time frame. While recognising that there are quite a number of formulations of training elements, these writers have

identified four conditions which appear to be both necessary to and adequate for the development of job-related skills in most vocations and professions (Ibid.: 479):

- (1) the exploration of the theory of the skill through lectures, discussions, readings, and so forth;
- (2) the demonstration of the skill (modelling);
- (3) the practice of the skill under simulated conditions;
- (4) feedback about performance.

This theory-demonstration-practice-feedback strategy was employed by the researcher during the implementation phase of the CAA case in Hong Kong, but there were two modifications.

First, demonstration and practice of CAA skills were done directly in the workplace, rather than under simulated conditions. This was found both acceptable and welcoming by the trainees because there was no interfering into classrooms, in contrast to teachers learning new teaching strategies.

Second, feedback to learners in CAA could come directly and spontaneously from the computer. Success or failure in an operation was straight forward to the learners. The major role of the trainer was thus to give comments and help in problem-solving when certain operations were unsuccessful.

Given these more favourable conditions, it was anticipated that the CAA innovation would be more easily implemented compared with other educational innovations in curriculum or teaching where outcomes are student-dependent and success less observable.

6.6.3 INSTITUTIONALISATION

With successful initiation and implementation, people within the user system will be able to master the new technology of CAA with confidence, gaining the benefits of the innovation deliberately intended at the start. The innovation will be

no longer something new to the organisation, and the use of it will become a matter of routine. In other words, the innovation will have been incorporated as a subsystem into the school and the implementation phase reaches a sustained stage. This end state of the innovation process is the state of institutionalisation, when the mission of the change agent system is accomplished.

6.7 RESEARCH QUESTIONS FORMULATED FOR CAA IN HONG KONG

The development of a tentative model in 1986 for managing the CAA innovation brought the first part of the thesis to a close but marked the start of its second half. When the researcher returned to Hong Kong after spending a year in London with the Institute of Education, a part-time research was done to investigate the CAA innovation in local secondary schools. Building on his experience gained in the ILEA case-study, two leading research questions were formulated.

First and foremost was the question of how applicable the tentative innovation model might be for CAA innovation in Hong Kong secondary schools and how could it be enhanced -- especially for the implementation phase which was not studied in the ILEA case. Second, during the two year CAA pilot project in ILEA a number of factors (including barriers and supporters) were identified as described in Section 6.2. Problem areas included funding, training, staff mobility, as well as possible structural changes in the organisations. Despite these barrier factors, it was noted by many of the pilot schools in ILEA when the project was evaluated, that CAA was beneficial -- more efficient, more effective, more accurate and less time consuming over the manual method in administrative work. How similar or relevant would these factors be in the Hong Kong secondary school context was the second research question to be investigated. In other words, the second leading question for research was to address the factors of managerial concern associated with the CAA innovation in Hong Kong secondary schools.

CHAPTER 7

A SCHOOL CAA INNOVATION CASE IN HONG KONG

7.0 INTRODUCTION

This chapter presents the CAA case study in Hong Kong. The context of the study and characteristics of the case schools are presented in the first two sections. Features of the innovation system concerned - the HKSAS - are then explained in Section 7.3. Subsequent sections are devoted to address the research questions formulated in Chapter 6. Section 7.4 details the innovation process in the study school SMC and Section 7.5 outlines the extent of CAA application (up to 1990) of the four schools studied. With these background the CAA innovation process is analysed and interpreted in Section 7.6 using the tentative model proposed in Chapter 6, with a 'SIX-A' model developed as a result of the findings. The last section of the chapter reports on management concerns identified with CAA as an innovation in the four local schools.

7.1 CONTEXT FOR EDUCATIONAL RESEARCH IN HONG KONG

Before describing the context specific to the study of CAA, it is important to initially present a general picture for educational research in Hong Kong. Overall the climate, support, and resource are not conducive for educational research activities in Hong Kong schools. For example, research of the kind conducted by Hargreaves (1984, *Improving Secondary Schools*) have never been done in Hong Kong. With twenty years of experience in the educational field in Hong Kong, the writer is of the opinion that the majority of teachers and principals consider educational research as something just for the academics in the higher education institutions and remote from the professional needs of teachers. School-based research is rare. Some reasons for this culture are given below.

There is a unit within the Hong Kong Education Department called the Educational Research Establishment (ERE) that collects statistical data from schools. These include data such as pupils' age distribution and their attainment test scores; and teachers' particulars on appointment and on resignation. As far as the writer can observe from his own working experience as a principal for twelve years, there is no continual and systematic effort on the part of the Education Department to conduct studies about the quality of education, or the ways to improve it. May be there are such investigations carried out, but they are all restricted for Government internal use and are never published or available. Schools are simply data suppliers and not users of educational research conducted by the ERE to improve their educational provision.

Much the same holds true for research conducted in Hong Kong by academics or students in education. Although these works are available from the individual libraries of the higher institutions, their circulation or publicity seldom reach the lay teachers or principals, or interpreted for practical usage in schools. This perhaps is attributable to a view that the value of educational research has not yet been recognised by many teachers and principals. Resource and support by the Government or other educational bodies for educational research are limited. This may be the cause of the culture which under-values educational research on the one hand, or the consequence of it on the other. For instance, there is no publication in Hong Kong equivalent to the TES (Times Educational Supplement) in the U.K. Regarding reference and literature to research, what the libraries in the two universities can offer is very limited compared with what the writer could read and review in London in 1985 to 1986.

The scenario for educational research in Hong Kong is not a lively one by comparison to the U.K. Some enthusiastic local people in the faculties of education of the universities have recognised the issue and a number of attempts are being made to change the situation. For example, the faculties of education now publish more education papers and disseminate them to schools at very low cost. Furthermore, the Hong Kong Educational Research Association (HKERA) formed several years ago has annual conferences which are organised for local academics, teachers and

administrators for paper presentation and discussion. Although people interested in these activities represent only a small proportion at this time (1991), more efforts made by these people in this direction will hopefully change the culture for educational research in Hong Kong over time. Schools it is hoped will become receptive to educational studies, rather than negative to them (as also described in Section 1.2), when teachers and principals see the need for them.

The concept of 'local management of schools' now adopted in Britain has not yet been taken up in Hong Kong where schools still lack autonomy in many areas. With a standardised and centrally controlled class structure, curriculum, and number of teaching staff, local schools have little flexibility to cater for the different needs of their students. Such limitations in financial and human resource allocation preclude the need and opportunity for schools to plan much. Unless some change is made in the basic educational policy, there would not be a place in Hong Kong for sophisticated management information systems as Lancaster (1989) has described in Britain or decision support systems as Fisher et al. (1990) have advocated in the U.S.A.

7.1.1 CONTEXT & BACKGROUND TO THE STUDY

Secondary schooling in Hong Kong is provided by three different sectors encompassing approximately forty government schools, thirty private independent schools, and four hundred government-aided schools. Schools in the aided sector are financially almost entirely supported by the government and are controlled by a common 'Code of Aid'. This 'Code' lays down the administration rulings for school management committees responsible for running aided schools in Hong Kong. Administration in aided secondary schools is thus centralised and standardised regarding areas like buildings, teacher-to-class ratio, class size, class structure, as well as curriculum.

In 1982, the curriculum innovation of Computer Studies was introduced by the Education Department in thirty secondary schools in Hong Kong as a pilot project.

By 1990, over ninety-five percent of local government and aided secondary schools have microcomputers for teaching purposes. There is yet no central policy regarding the use of computers for school administration but many schools developed their own software in CAA once they possessed the machine. Some schools, about twenty-five in number, have chosen to use a dedicated software package produced by a software house -- the HKSAS (Hong Kong School Administration System), rather than involving themselves in program development. Details about the 'technical' environment for CAA in Hong Kong secondary schools have already been described in Section 4.3.3 and are not repeated here. It is only necessary to point out here that the environment was one conducive to CAA in local secondary schools, as indicated by the increasing popularity of the innovation over the past few years in Hong Kong secondary schools (Fung 1983, 1991).

7.2 THE USER SYSTEMS - CHARACTERISTICS OF THE SCHOOLS

This chapter reports on the case of a school's CAA innovation process using the HKSAS software, with comparisons and contrasts from three other HKSAS users. The study school is named as SMC, and the other three secondary schools for cross-checking or 'triangulation' of the innovation process are called respectively WTS, YKH, and NPC. It is necessary first to outline the characteristics of these schools in the following paragraphs to make clear the setting in which the CAA innovations took place.

A. School SMC - The Study School

SMC was set up in the year 1973. It was an aided girls grammar secondary school. It was run by a religious organisation and both its supervisor and principal were Catholic sisters. Being an aided school, the premises and facilities in SMC were standard according to regulations set out by the Education Department of Hong Kong, with twenty-four classrooms and twelve special rooms and laboratories. At the time of study, the school operated twenty-nine classes from Secondary 1 to

Secondary 7, with a student enrolment of about one thousand and fifty. Like most other local secondary schools, SMC was operating with a 'floating class' system, i.e. six of its classes did not have home-rooms and could use only rooms vacated when other classes went for laboratories or special-room lessons like music or home economics. Such a 'floating system' was a constraint when preparing the school time-table.

The principal, aged around forty and with a B.A. degree, had been in the post since 1978. She had no experience or training with computers. The other fifty-one teachers in SMC were all females mostly in their thirties and early forties. A few teachers were younger in their twenties. The CAA system supervisor, Miss K, was one of them and she was a graduate teacher.

The curriculum offered in SMC was standard according to what was recommended by the local Curriculum Development Council and it had just operated the subject of computer studies in Secondary 4 and 5 for one year at the time of study. Miss K was the computer studies teacher and for this reason was chosen by the principal as the CAA system although she had been with SMC for only two years.

There were nine supporting clerical staff members at the time in the school office of SMC including two Catholic sisters in charge of school accounts and the general office, and the others were in their early twenties. During the time of study, this number of staff was reduced from nine to six between 1987 and 1989 when the school faced a cut in administration grant by the Education Department as a matter of general policy.

B. *School WTS*

WTS was established in the year 1975. It was a coeducational aided grammar secondary school. It was run by a non-profit-making commercial and industrial organisation with no religious background. The school premises covered an area of fifty thousand square feet and facilities were standard in it as an aided school. It had

twenty-four classrooms and eleven special rooms and laboratories. At the time of study, the school operated twenty-nine classes from Secondary 1 to Secondary 7, with a student enrolment of about eleven hundred. It operated also with the 'floating class' system just as in SMC.

The principal, in his early fifties, held an M.Ed. degree and had been in the post since the school was set up. He had no background experience or training in computers. The other fifty teachers in WTS, about half of each sex, aged between mid-twenties and early fifties. The CAA system supervisor in the school was the deputy principal in charge of academic studies and a key member of senior management. He was a self-taught computer user but not a teacher of computer studies in the school. There were six supporting staff members in the school office.

C. School YKH

YKH was set up in the year 1969. It was a coeducational aided grammar secondary school. It was run by a non-profit-making voluntary organisation with no religious background. The school facilities were standard for an aided school, with twenty-four classrooms and nine special rooms and laboratories. At the time of study, the school operated thirty classes from Secondary 1 to Secondary 7, with a student enrolment of about eleven hundred. It operated also with the 'floating class' system just like most other aided secondary schools in Hong Kong.

The principal was in his early fifties and held a B.A. degree. He was the founding principal of the school. He had no training in computers, neither any experience in using the machine. There were fifty-one teachers in the school, about half of each sex, most of whom were aged between the late thirties and mid-forties. The CAA system supervisor in the school was the prefect of academic studies, who was the English department head as well. He had no formal training with computers but possessed a personal computer himself for word processing. There were five supporting staff members in the school office, all being computer 'illiterate' when YKH began its CAA.

B. *School NPC*

NPC was established in the year 1987. It was a coeducational aided grammar secondary school. It was run by a non-profit-making association with no religious background. The school premises covered an area of sixty thousand square feet and facilities were standard in it as an aided school. It had twenty-four classrooms and thirteen special rooms and laboratories. At the time of set up, the school operated only six classes of Secondary 1 and four classes of Secondary 4, with a student enrolment of about four hundred. The final class structure of the school by 1991 was thirty classes from Secondary 1 to 7 when it had to operate also with the 'floating class' system.

The principal of NPC was a lady in her early fifties, she held a B.A. degree and had no training in computers. However, she had been a principal before in a school which was a user of the HKSAS. The number of teachers in NPC grew from fifteen when it was set up to fifty-one by 1991. Initially, the CAA system supervisor in the school was a secretary employed by the principal specifically because she had previous working experience with computers in the commercial field. After this secretary left for another job in 1989, the principal directed the dean of studies in NPC to take over the duty of the CAA system supervisor. He was assisted by the teacher of computer studies and the laboratory technician in the school. There were only three supporting staff members in the school office when it was first set up.

In summary, the four secondary schools at the time of study all belonged to the aided sector in Hong Kong and had a comparable student enrolment of about eleven-hundred, with a teaching staff of around fifty and an office staff of about six. Computer Studies was offered as a subject in all of them and so there were qualified teachers with computer knowledge in each school. They were users of the same HKSAS computer system, though with different lengths of time and different levels of application (see Sections 5.4 & 7.5).

SMC was the school where the researcher acted as a 'semi-participant-consultant' (see Sections 5.3.4 & 7.4) for the CAA innovation. It was a girls' school while the other three were coeducational ones. The school had been open for sixteen years, about the same as two others - WTS and YKH. The last school, NPC, had been operating for three years as at 1990.

Many of the findings for the innovation process relate necessarily to the 'innovation system' (see Section 6.5.2). Before revealing how each school went through its CAA innovation, a general overview of the computer software package (the HKSAS system) that the study schools adopted is outlined in the following section to provide an understanding of the technical aspect of the innovation.

7.3 FEATURES OF THE INNOVATION SYSTEM -- THE TECHNICAL ASPECT

The HKSAS software system for secondary school administration on microcomputers was sold to local schools in a package consisting of five modules -- Student Data Management; Test/Examination Results Handling; Timetabling; Teachers Leave and Substitution Management; and School Accounting. Details of the functions in the different modules are included for reference in Annex D.

The system was developed to run on 16-bit microcomputers with a minimum hard-disc storage of 10 Megabytes. Different models of 16-bit machines currently found in schools using the system in Hong Kong include the IBM, Fujitsu Micro 16SX, the Wang PC, and the Philips. On the Fujitsu machine under its CCPM operating system, the HKSAS caters for a multi-user environment as well in contrast to a single-user situation for the other machines. This system was produced by the joint effort between people in the educational field (including the writer) and professional programmers in the 1980's. It was marketed to schools and supported by a local computer firm. About twenty five schools had purchased the package as at 1991 and the researcher's school had been a user of the system for over eight years. Technically, the HKSAS was designed to meet the following ten criteria (see Hurst, 1986):

- (1) Ease of use with minimum training necessary for ordinary school office staff and teachers who are not computer experts.
- (2) Totally menu-driven with standard and consistent screen presentation.
- (3) Use of programmable function keys wherever appropriate.
- (4) With data integrity basing on the principle of single-entry but multiple-use of data.
- (5) Built-in input data-checks on screen where appropriate and hardcopy validation when necessary.
- (6) Password protected with different levels of screen access using different userID's and passwords. Thus allowing access by different users yet under control of school authority.
- (7) Data encryption where necessary for added security.
- (8) Have sufficient flexibility for each school to impose its own individuality, within limits.
- (9) Ease of software maintenance with upgradable development path for future expansion.
- (10) Without loss of file security and data integrity, data file structures should be easily transferable across systems on discs and over telecommunication.

According to Lancaster's (1989) distinction of computerised systems for school administration and for school management, the HKSAS system would belong to the former category, basically being 'datalogical' rather than 'infological'. Except for the timetabling module where management decision-making can be said to be computer-supported to some degree, other modules represent only transformations of routine and structured school tasks from a manual to a machine system.

7.4 THE CAA INNOVATION IN THE CASE SCHOOL SMC

The tentative model proposed in Chapter 6 for managing an innovation process was followed by the researcher in the case school SMC, and used as a tool for analysis in the other three schools. Details of what happened in the school SMC is first described in this section, and data collected using the interview guide (Annex C) from the other three schools for 'triangulation' are presented in later sections.

In November 1986, the accounting clerk Sister B of SMC visited the writer to discuss some matters related to school accounting. She noted on the occasion that the writer's school had been using the HKSAS accounting module for some years. She got interested in the idea of using a computer to handle her own school accounts and within a week wrote a letter to the researcher seeking advice for CAA. A letter of reply from the researcher prompted further discussions with Sister B of SMC.

A meeting was arranged with Sister B in late November at the researcher's school to explain and demonstrate to her on the computer what CAA is about, using the HKSAS. Sister B was thus given an overview of CAA by the researcher and not just awareness of managing the school's accounts with a computer. The intention of the researcher to locate a case-school for research was also relayed in the meeting. This stage may be interpreted as the very first awareness stage for CAA for the initiator in SMC as well as the preliminary stage of negotiation for entry of study by the researcher.

Nothing happened for more than a month until Sister B phoned again in mid-February 1987, saying that her school's supervisor and principal had got interested also in CAA and a budget of HK\$30,000 had been made available for the innovation. The senior management at school SMC, by that time, had adopted the idea of CAA as an innovation with potential benefit to the school and was at the stage to search for more information and to learn more about it.

A meeting between the researcher and the SMC school supervisor, the principal, and Sister B was then arranged on 25/02/87 at the researcher's school. The school's intention to start CAA was confirmed and the principal indicated that a budget of HK\$30,000 was available for the innovation. This intention was welcomed by teachers of SMC, as the principal remarked, at their last staff meeting. Both the supervisor and the principal, however, had no computer background. They had heard, from their teachers and other schools, about using computers in preparing student reports; and Sister B's recommendation after visiting the researcher in November 1986 prompted their decision to adopt the idea. They were happy to have the consultancy from an experienced practitioner of CAA like the researcher assisting SMC in the innovation while conducting his study.

Having agreed to the joint venture, the researcher then explained to the SMC visitors what CAA was about in general, and demonstrated the various functions of the different modules in the HKSAS package in use at his school. Some papers describing the general features of the HKSAS package were given to the principal. The need to view the innovation as a process rather than an event (Section 3.11.2) was pointed out, and the researcher suggested that SMC should set up a CAA team as a start. Future support from senior management to the team as a necessary criterion for innovation success was also explained to the supervisor and principal (Section 3.11.5). This first meeting lasted for about two hours and was adjourned after fixing the date for another meeting on 4th March, 1987.

Besides a negotiation of entry to research, the first meeting with the senior management of SMC was practically a session for awareness and understanding on their part. On reflection, it indicated clearly that decision-making for adoption of an innovation is a complicated cybernetic process. From a very preliminary awareness stage of the possibilities with CAA, the supervisor and principal of SMC adopted the idea, searched for more information and understanding, before deciding really to go for it. The tentative model for the innovation process outlined in Section 6.6 thus needed refinement to take account of this aspect (discussed in Section 7.6.3).

One outcome of the meeting was a decision on the part of the principal of SMC to form a CAA team. Six teachers were selected by the principal as team members, based on their existing duties and position in the school as the researcher could observe. These included the computer teacher Miss K as the CAA systems supervisor, the deputy principal, two teachers in charge of school time-tabling, and two other teachers to assist Miss K. Only Miss K and the two time-tablers had experience in using microcomputers.

The CAA team of SMC with their supervisor and principal met the researcher on 4th March, 1987 as scheduled at their school after class. This meeting may be interpreted as the diffusion of awareness to key participants (the six teachers in the CAA team), leading to their adoption of the CAA innovation idea. This was a key opportunity for the researcher to explain to the group of teachers the purpose of his research, the joint nature of the venture, and the possible mutual benefits, i.e. the researcher permitted to study his case, and SMC being helped by an experienced practitioner of CAA to develop its innovation.

During the meeting, choice of hardware for CAA was discussed. Within the budget available, an IBM compatible machine was agreed as the most probable choice. Alternatives of software were also explained by the researcher. Cost and benefit were discussed about different approaches of (i) self-developing programs by teachers with the expertise to write programs; (ii) using business standard packages (like spreadsheet and dBase II or Dbase III); and (iii) using the HKSAS. Owing to the limitations of time and expertise in programming within the school, it was decided by the CAA team to first study the third alternative listed above.

The participants in the meeting had already read through the papers about the HKSAS package previously given to the school and the researcher helped to explain some questions raised about different technical functions of the modules. Recognising that such verbal explanations were definitely insufficient, the researcher suggested that the CAA team should see a demonstration of the package at work. There was also concern about which administrative area to choose as a start in CAA. Some team

members preferred to start with the timetabling module since that would least involve or disturb other teachers. Further discussion concluded that it would be better to decide on that issue later -- after the CAA team had had a detailed review of the HKSAS in operation. After dealing with those aspects of CAA thought to be of greatest interest to the SMC staff, the researcher explained in general the tentative model of the change process intended to be adopted in the project in the time remaining of the two hour meeting. It was then arranged for the team to see a demonstration at the researcher's school in the afternoon of 6th March, 1987.

The CAA team of SMC saw the HKSAS demonstration as scheduled on 6th March, 1987 in the researcher's school. It was the first time for the team members to see an integrated CAA system at work and they showed much interest by asking questions as the researcher went through the different modules. The members were enthusiastic also in their discussion about the applicability of the different functions of the HKSAS to their school. Although there was no opportunity for some hands-on experience with the HKSAS package for a group of six people, the observability of the innovation system at work helped to shape the positive attitude of the participants towards the innovation and a follow-up meeting was scheduled on 13th March, 1987. Key participants were thus given time before the next meeting to consider suitability of the HKSAS for their own school, as well as to make decision whether to adopt it as in their CAA innovation.

The next meeting was held a week later at SMC school. The staff on the CAA team had had an opportunity to reflect on their experience at the researchers school with the result that they agreed to adopt the HKSAS package. The members of the team agreed that this standard software package could meet their school's requirement to a large extent. Minor modifications like the format of the student report print-out would be needed. The idea of 'home-grown' CAA software was discarded in view of what was already available in the HKSAS, the lack of experienced programming expertise within the school, and the time demanded of teachers to write their own programs.

The question of experience and qualification needed from the school's clerical staff to support CAA was discussed. It was explained by the researcher that teachers and clerical staff should expect to be trained as users only of the package rather than programmers. Thus computer knowledge and experience on their part would be an advantage but not a necessity. It was also explained by the researcher that CAA was intended to aid rather than to completely replace existing manual practices. The two should be complementary to each other. The principal of SMC and her CAA team then decided to contact the HKSAS software supplier within the next week. The possible physical location for the hardware to be installed was also identified in the general office where there was sufficient space and accessibility. The date of next meeting was left open pending contacts with the software supplier.

Contact between the software company and the school SMC was then arranged by the researcher. A tri-party meeting was arranged after seven days including the school, the researcher, and the company to discuss on future roles of each party. The meeting took place at the office of the HKSAS supplier. The SMC group included the supervisor, the principal, the accountant, and the CAA team of teachers. The manager Mr. L of the company was clearly keen to supply the HKSAS package and agreed to do so within the budget of the school (HK\$30,000). A whole system for CAA including hardware and software could be provided -- using a Fujitsu-16 microcomputer similar to other existing school users, instead of an IBM compatible as the school initially intended. The price was significantly lower than the market price (HK\$65,000 approximately) and therefore attractive to the school. The researcher, however, was to be responsible for the training and operational support of the software in the school during the research period instead of the company doing so as for other users. This provided the researcher the opportunity of dealing with practical difficulties during the innovation process while the company was compensated in part for cutting the price. The SMC staff were all pleased with the offer, except the teacher for timetabling who showed preference to use IBM compatibles. Mr. L also explained that maintenance charges for the hardware after the warranty period of six months would be calculated according to the list price of the hardware. The school could opt for a comprehensive maintenance estimated to

be HK\$4,000 per annum or, alternatively, pay on a per call basis as the need arose. Mr. L then showed the group the general features of the HKSAS system, which covered the general areas in school administration similar to that in the researcher's school but operationally different because of different hardware and software.

Discussions then followed mainly on the choice of hardware. The pros and cons of the Fujitsu-16 (not IBM compatible as decided by the SMC staff in the meeting on 4th March, 1987) against the IBM-AT (or its compatible) were compared. On the positive side for an IBM machine, the manufacturer was considered more reputable and there were more standard business software available for word processing, databases, and spreadsheet applications. However, the HKSAS package could be used on IBM's only as single-user microcomputers, and also only on monochrome monitors. According to Mr. L, there was only one existing user at the time using the HKSAS package newly developed by the company on IBM computers with a short field history of about 6 months. In contrast, over ten users had been using the Fujitsu, some with a field history of over two years. Thus the package had a well-tested user history on the Fujitsu. Furthermore, the Fujitsu HKSAS version could work on colour monitors and was expandable to a multi-user environment using either dummy terminals or IBM micros as user stations. In the latter case all commercially available software could be used as well when the IBM additional station was installed.

Having an understanding of the additional features of the HKSAS version on the Fujitsu machine, the SMC staff found the offer an attractive one. They did not make a final decision at the demonstration but agreed to contact the company directly for the purchase when they had done so.

Subsequent to the meeting on 19th March, 1987, the school SMC decided to order the HKSAS package from the company, using the Fujitsu version. The installation took place on 8th April, 1987. At that point, the stage of adoption for trial of the CAA innovation was reached by SMC according to the researcher's tentative model (Section 6.6). On reflection and referring to Fullan's (1991:63)

considerations in planning for innovation adoption, it can be said that SMC by then had met with the three R's -- Relevance (Practicality + Need); Readiness (Capacity + Need); Resources (Availability) of the initiation phase.

After the installation of the HKSAS package at SMC, a schedule was agreed on 14th April, 1987 between the school and the researcher for the training to use the CAA system, starting 29th April, 1987 till the end of May 1987. A total of ten sessions each of three hours held after school hours was scheduled to cover the modules of Student Data Management, Timetabling & Teacher Substitution, and Test/Exam Records Handling. Because of the interest of the CAA team of teachers to get the system into operation in the above three areas in the new academic year beginning September 1987, it was agreed between the CAA team, the school accountant Sister B, and the researcher to do training for the accounting module only after the above-mentioned modules were operable. Two accounting training sessions were later given in March 1988. With limited computing facilities, this decision would enable more people to share some immediate innovation benefits, e.g. the general office staff in managing student data, the timetablers in preparing the school timetable, and teachers in preparing student reports. In the view of the researcher, it was a reasonable decision by the CAA team to give the school accounting a lower priority in the innovation, since building on a number of small successes is an important strategy in managing a change process (Turrill, 1986; see Section 3.11.2).

At the request of the researcher, the CAA team of SMC agreed to keep a log-book for the using of the CAA system and to note down irregularities and problems found in using the system. This log-book was found useful not only for problem-solving by the researcher as a trainer but also a valuable source of data in the thesis. For example, it could be traced from the log-book that the users did not know when to do backup discs for the data files before attempting certain key functions. The timetabler in SMC made a mistake of this kind in her first try with the timetabling module. The whole school timetable was near completion except for the assignment of rooms to floating-classes (Section 7.2) to finish the job. No backup was taken at that stage before running that last function of room assignment. When she was later

unsatisfied with the outcome of the room allocations, she could not attempt a different assignment because the original timetable had been modified. From such mistakes which the researcher as trainer also had to bear responsibility, the researcher also came to recognise the 'black-box' effect encountered by users of large and complex integrated systems in CAA -- a phenomenon to be explained in Section 7.6.2.

At the meeting on 14th April, 1987 the CAA team of SMC and the principal, after discussion with the researcher, decided also that the academic year 1987/1988 was going to be their year of trial implementation with HKSAS according to the following objectives:

- | | |
|-----------|---|
| June 1987 | Timetabling by computer; |
| Sept 1987 | Teacher Substitution by computer; |
| Sept 1987 | Student data management and computerised report cards for Secondary 1, 3, and 6 only. |

Subject to success of the implementation of these objectives with the training and support by the researcher between April 1987 till August 1988, student data management and computerised report cards would be expanded by the SMC CAA team in a phased manner in the following years to cover the whole school:

- | | |
|-----------|----------------------------------|
| 1988-1989 | Secondary Years 1, 2, 3, 6, 7 |
| 1989-1990 | Secondary Years 1-4, 6, 7 |
| 1990-1991 | Whole school secondary Years 1-7 |

In these later years of phased expansion, the researcher's role shifted from that of trainer and technical supporter to that of an external observer.

Training by the researcher was carried out in SMC as planned and the way it was handled, in contrast to how it was done by the HKSAS supplier for the other three schools WTS, YKH, and NPC, is explained in Section 7.6.2. By 25th August, 1987, the CAA system in SMC was ready for management in the academic year 1987-1988 for the Student Data Management and Timetabling and Teacher Substitution modules.

During the period of training, a trial run on the Test/Exam Results Handling module using past examination data was carried out. The trial was a success except that the school found the layout and format of the report card unsatisfactory. The HKSAS supplier was then paid about HK\$2000.00 to tailor-make a report printout program for SMC. The module was ready to be used in the first term examination in December 1987.

It is appropriate to reflect, at this point, the different roles of the researcher during the innovation process of CAA in the study school SMC, and to clarify more concretely the meaning of the term 'semi-participant-consultant' used by the writer in describing these roles (see also Section 5.3.4).

During the initiation phase, the researcher was a change agent and participant from the beginning till the stage of adoption for trial (up to the time of installation of the CAA system). He also acted as a consultant in CAA by providing information and alternatives for the school SMC. Although not a member of the school, his expertise and experience in CAA had a part to play in clarifying some uncertainties that participants had about the innovation, and in shaping the attitudes of the participants for the innovation (both through discussions in the different meetings and demonstration sessions for the senior management and the CAA team of teachers previously described). His involvement had also strengthened the confidence for the participants to go for a trial implementation.

The role of the researcher shifted to that of trainer and operation support between April 1987 to August 1988 and subsequently to the role of an external observer and advisor to the CAA system supervisor when she needed help in running the system. Such a relationship helped to build up the rapport between the researcher and the CAA system supervisor in SMC so that her personal views and problems encountered during the innovation could be quite frankly communicated to the researcher.

It was with these different roles of the researcher (which is called 'semi-participant-consultancy' as a short-hand in the thesis) that the tentative innovation process model proposed in Chapter 6 was put to field work in SMC. The researcher kept minutes of different meetings as well as a record of the events that took place with notes of personal observations where he (unavoidably subjective at times) thought appropriate, being mindful about possible reference to literature and his tentative model as much as he could in doing so. In addition to data collected about the CAA innovation in the study school SMC in this manner, a semi-structured interview-guide was also developed for data-collection. This instrument (included in Annex C) was developed to address the research questions formulated in Section 6.7, it was piloted and revised before data-collection in SMC and the other three schools WTS, YKH, and NPC used in triangulation.

Data were collected by interviews with key participants in CAA of each school. The three interviews with WTS, YKH, and NPC were conducted between February and March 1990, and a final one with SMC in April 1990. In all the four schools, the principals were first approached by the researcher to be interviewed. However, the three principals of SMC, YKH, and NPC indicated that they could only supply data about their schools and their personal background, and recommended their CAA system supervisors for the interviews. These three principals admitted that they knew much less than their system supervisor about CAA in their schools. The principal of WTS, in contrast, felt sufficiently informed about the CAA system in his school to accept the interview himself. To some extent this reflected different levels of understanding and knowledge on the part of the four principals about the CAA innovation in their schools. This may be an interesting point to note when the success of the CAA innovation at WTS was found greater than YKH and NPC in comparison (Section 7.5). Leadership in change management is a key criterion for success as explained in Section 3.11.5 and the principal of WTS certainly demonstrated a leadership style different from the other three principals. This will become clearer when the innovation process in the four schools are discussed in Section 7.6.

Data collected in the field work from the four schools are presented in the following sections. Instead of describing the other three school cases independently as for SMC in this section, findings from the four schools have been grouped together for discussion and interpretation in the following order for better comparison and contrasts:

1. Extent of CAA application in the schools;
2. The innovation process, divided into the initiation phase, and the implementation phase; leading to the writer's proposal of the "Six-A" process model of an innovation;
3. Management concerns specific to CAA.

7.5 EXTENT OF CAA APPLICATION IN THE SCHOOLS

In this section the extent of use of the HKSAS applications in the four schools WTS, YKH, SMC, and NPC are reported. This serves only to provide a background picture for the discussions of the implementation of the CAA innovation that come in later sections. *Details of the difficulties encountered by the schools are not included in this section but are described in Sections 7.6 and 7.7, where the innovation processes in the schools and management issues specific to CAA are discussed.* Barriers and reasons for delays or failures, in the writer's view, can be more clearly understood with a parallel discussion of the innovation process in the context of each school.

WTS: Its CAA system was installed in 1983 and this school was the oldest HKSAS user among the four schools. All the five main modules of the HKSAS system were in routine application: Student records, test/ examination results handling and reporting, timetabling, teacher substitution, and accounting. The school has additionally written applications on its own for analyzing student in-take. There was no specific plan for expansion of application but the Principal said that he would consider adopting modules such as for library maintenance and inventory control if available.

YKH: It installed the HKSAS system in 1985 and the only module in routine application by 1990 was the timetabling module only. Other modules had been tried for a short period but not put into routine application. Several reasons were reported by the Dean of Studies: (i) the pupil data module and the test/examination management module were not fully compatible with their school's existing practice, and there was no intention to adapt ongoing habits to match the CAA system; (ii) the software house was not supportive when asked to modify their programs for individual schools; (iii) training was done for the entire system in a matter of just a few days during the summer holidays without further on-site support.

The timetabling module was put into practice immediately afterwards because the timing was appropriate, but not the other modules that simply faded out of use afterwards. The abortion of the major use of the HKSAS by this school indicated that its CAA innovation could not be institutionalised. As an alternative, the school purchased two IBM compatible microcomputers and began its own software development by two teachers in the following two years. The Fujitsu computer with the HKSAS package was moved from the office to the school library to be used only once in a year for timetabling only. Student personal records and examination reports were computerised a year later on the new IBM compatibles. In-school development by the two teachers for student past records was on the agenda. As for the dedicated school accounting module in the HKSAS, the accounting clerk never really used the system after her initial training. The physical location (in the library) of the machine had created inconvenience for its use by the clerk on the one hand, it also indicated perhaps the lack of interest on the principal's part to computerise the school accounts on the other. However, the accounting clerk was attempting the use of spreadsheet on her own initiative with the IBM machines because of its popularity as an administrative device; and because they were easily accessible in the office.

In the ILEA case in the U.K., one barrier to the CAA innovation found in some pilot schools was also inconvenience for the access of the computers by staffs, though for a different reason because of over-concern about physical security requirements. Ease of access to the machines should thus be given due regard in the CAA innovation.

NPC: This was a new school opened in September 1987 when it installed the HKSAS system at the same time. The Principal was a user of the same HKSAS system in her previous school and wanted NPC to be computerised right from its inception. Although the software was the same, NPC used an IBM compatible microcomputer whereas the other three schools used the Fujitsu 16. Time was to show that this was a wise decision as Fujitsu ceased to manufacture the Fujitsu 16 model microcomputer. The timetabling module was the only part in routine application since installation. Student personal records were computerised between September 1989 and December 1989 -- two years after installation of the system (see Section 7.6.1) for explanation). As for the test and examination module, the school was at the trialing period in early 1990. The school was working towards the full application of all the modules available in the HKSAS system. The CAA innovation in this school therefore had not yet reached the stage of institutionalisation after a period of two years.

SMC: The school installed the HKSAS system in June 1987 and all the modules were in routine application except for the accounting module by the end of 1988. The accounting clerk who took the training was in the period of trialling the accounting module when she left SMC in 1988 and no follow-up by the substitute clerk was instigated by the Principal. The outcome was that the accounting module was unused thereafter. The Principal did not inform the researcher about the staff change when it happened. One reason could be that she thought a change in clerical officer unimportant, or she might not be really keen in computerising her school's accounts compared with other CAA functions (see Section 7.7.11 for further discussion).

7.6 THE INNOVATION PROCESS

The discussion that follows centres around the process of the CAA innovation and is divided into three sections. The first section is about the initiation phase, the second the implementation phase. The last section is an integration of the previous two into a proposed "SIX-A" model for the whole innovation process -- the 'Post-Study Version'.

7.6.1 THE INITIATION PHASE

In SMC school the researcher participated in the CAA innovation process. The other three schools reported in interviews on their progress for the innovation. SMC followed the framework of the researcher's tentative model (Section 6.6), the other three schools reported that they did not apply any particular change model. What happened in each school before installing the HKSAS are examined below to reflect the different managerial approaches during the initiation phase.

YKH: The Principal had no computer background but he picked up the idea of CAA from another school (a HKSAS user) belonging to the same sponsoring body. He arranged a demonstration of the HKSAS system by the supplier at the school for the teachers. The system was then purchased without a full understanding of its functions in detail and its compatibility with existing practice at the school. The Dean of Studies was then put in charge as the systems supervisor (the interviewee) to carry on, but without much success subsequently. The Dean of Studies remarked in the interview that it was mainly the principal's decision to buy the system, "perhaps because another school in our sponsoring body has computerised" as he said. Commitment to the innovation on the part of this systems supervisor was thus rather low from the start. Compared to the writer's tentative model, the initiation phase was omitted in this school for the CAA innovation, before its adoption; and teachers' participation was minimal.

For successful school innovations, Fullan (1991:63) has pointed out that early participation is important, and that it must be seen in the context of the early stages of a very long process of mobilization and meaning. He also suggests to conceive of participation as something that begins during initiation, and grows and grows through action. Lack of such staff involvement in the YKH case led the innovation into difficulties during implementation. It was a piece of empirical evidence in support of Fullan's (1991) view, and justified as well that a lack of ownership and shared vision (Turrill, 1986) of the innovation on the part of key participants leads very likely to innovation failure (see Section 3.11.5).

NPC: The Principal, although without any computer background, had success in using the HKSAS system in her previous school before coming to NPC. In that school, the Deputy Principal who had initiated the idea and another senior teacher took total responsibility of CAA. When this Principal started NPC, she thought that computerisation was "simply like buying in a new piece of equipment" (in her own words) and expected similar success as in her previous school. She had specially hired a secretary who had computer training to take charge of the HKSAS system purchased. Teachers were not involved at all before the decision to use the system was made. The secretary and office staff were to be responsible with the CAA system -- to save teachers' time from administrative work. In the end, the secretary did not succeed and she left the school after a year. Besides technical reasons during the implementation phase which will be explained in Section 7.6.2., there were several reasons for the secretary's failure which were attributable to problems during the initiation phase: (1) ownership of the innovation was a problem as she was hired after the system was purchased; (2) inadequate training was provided for her (see Section 7.6.2 for the way training was provided); (3) internal support from the Principal or other teachers was not available as she was the only person assigned the responsibility.

Several comments can be made at this point comparing the two cases above with literature on managing change (Chapter 3). First there is a need for proper management of any educational innovation, like CAA. Failing to recognise this need severely impedes the success of an innovation. CAA was not like buying in a new piece of equipment, as both Principals in YKH and NPC had thought. In Section 1.1 where the purpose of the study is explained, the writer has expressed his view that local principals are likely to under-estimate the complexities of the CAA innovation process. Moreover, the lack of a people-oriented approach will not generate ownership on the part of actors/participants -- crucial component for innovation success (e.g. Fullan, 1991; Turrill, 1986). A proper initiation phase, according to the writer's model, was omitted in YKH and NPC schools. The result was that the YKH school had to abort nearly the whole system, while the NPC school had to struggle with many subsequent problems.

WTS: In the discussion about the use of change models during the interview with the Principal of WTS, he responded as follows:

"I don't have any specific planning model to follow for the CAA innovation. But I involve them [teachers], find a reliable person to delegate to, and support them" -- Principal of WTS.

The Principal had no computer background and was not a computer user himself, although he was the initiator of the CAA innovation. He held an M.Ed. degree specialising in educational technology and had been aware of CAA possibilities in schools. Before making the decision to adopt CAA, he discussed the idea first with a group of four to five teachers that he had in mind to delegate responsibility to in future, including the Dean of Studies who was a senior member of staff. With their support, the idea was further discussed in a staff meeting. The whole teaching staff were thus made aware of the possible CAA innovation. Realising the possible reduction of their workload, teachers welcomed the idea and the small group of teachers (though not formalised as a CAA team) searched for further information in the subsequent two months, including visits to schools with experience in CAA and a HKSAS user. The group then formulated a proposal for the HKSAS

which was adopted by the school. The building of this teacher team to investigate and make proposal for CAA exhibited the Principal's management approach quite in line with the researcher's tentative model for the initiation phase of the innovation. Participation right from the start by key people generates commitment and ownership, as Fullan (1991) and Turrill (1986) have indicated. Judging from what this Principal has done, he had in effect led his staff through stages of awareness and helped them form proper attitudes towards the CAA innovation before he implemented it. In contrast to YKH and NPC, the proper initiation phase under the leadership of the Principal of WTS laid the foundation for success of its CAA innovation (see Section 7.5).

After the decision was made in WTS to adopt CAA, responsibility for implementation was delegated by the Principal to the Dean of Studies and the small group of teachers, with support from the Principal where necessary. For instance, members of this group were asked to handle the test/examination marks for all teachers and they were compensated by the Principal with fewer invigilation duties for examinations.

SMC: In recognition of the significance of awareness and attitude formation stages to the future success of implementing an innovation, the researcher had spent much effort with the Principal of the school and her CAA team of teachers for half a year through the initiation phase, before the innovation was adopted. Discussion meetings and visits to see the HKSAS system at work in a user school were the essential vehicles to carry the participants through what in effect was the first phase of learning in the innovation (See Section 7.4).

From the field work of the initiation phase in SMC, it was found that the strategies (Relevant Subsystem in Focus (RSF) and Action Approach Subroutine (AAS) approaches) recommended in the tentative model in Section 6.4.1 were practicable. Furthermore, if a relevant subsystem is neglected during this phase, difficulties will probably arise during the implementation phase. This was noted in SMC where

the CAA team formed by the Principal included only teachers and senior management. The office staff were not part of the 'relevant subsystem in focus' in the eyes of the Principal, they didn't participate in the initiation phase and were involved only in the later implementation phase of the innovation. In the view of the writer, this can be attributed to the management culture common in Hong Kong schools. Just like the case of the secretary in NPC, or the change of accounting clerk in SMC, office staffs are considered as subordinates simply to take instructions and work assignments from the Principal in SMC. The concept of recognising them as key participants in some school innovations is still absent from the minds of many Hong Kong Principals as in the NPC and SMC cases, and from the experience of the writer's contacts with local fellow Principals.

In SMC, the commitment and support from the office staff for the CAA system was found insufficient:

"For the management of student personal data, the office is clearly responsible. But for report cards, which has been traditionally the teachers' job, the office staff consider that teachers should still be responsible. They see no reason why they should be involved. They just perform their duties of stamping the school seal on the cards. I did try to list down with the secretary what I wanted the office to do, but nothing came about and there was no initiative from the office staff to do the necessary things in preparing for marks-entry into the computer. In fact, every time I asked the secretary to help initialise the test/exam registers, she did so apparently as a favour to me and that I was giving her extra work. We have never sit down to discuss clearly what the office should do in CAA." -- SMC CAA supervisor.

From this part of the study, several conclusions can be drawn for the initiation phase of a school's CAA innovation:

- (1) Given the same hardware and software, and within similar context, two schools succeeded but the other two didn't. The unsuccessful schools failed to recognise that CAA innovation is a process that needs to be managed, and not just 'buy in a new piece of equipment'. This is strong empirical evidence in support of the need for 'a theory of changing' (Fullan, 1991).

- (2) An initiation phase of the kind suggested in the tentative model, with stages of awareness and attitude formation, for relevant subsystems is fundamental for successful implementation.
- (3) A holistic view is necessary in defining the relevant subsystems. This was absent in the schools YKH, NPC, and SMC.
- (4) A people-oriented approach is necessary to generate shared benefits for an innovation and solicit genuine commitment for it on the part of subsystems, like the teaching and clerical staff, concerned.

7.6.2 THE IMPLEMENTATION PHASE

In this section the implementation phase of the three schools WTS, YKH, and NPC are first discussed, then followed by the case of SMC where the researcher acted as a semi-participant-consultant.

A common pattern was found in the implementation phase of CAA in the three schools WTS, YKH, and NPC after the installation of their HKSAS systems:

- (1) the supplier of the HKSAS system provided an after-sale operation training to a group of three or four staffs at its company, instead of on-site training at the schools;
- (2) the training lasted for three consecutive days for the whole system in a package form;
- (3) an operation manual was given and the small group of staff was then left more or less to work on its own, back at their school without on-site support;
- (4) telephone communications with the HKSAS supplier was the usual means of help given to the system supervisor in case of problems.

This simplistic pattern was found deficient in several aspects for successful implementation of CAA in a school, the result was that only one school (WTS) among the three (see Section 7.5) was successful through the implementation phase. Difficulties and problems encountered in the other two schools are discussed below.

YKH: The staff working with CAA in this school were unclear about the objectives of the innovation, as the system supervisor reported. They vaguely knew that computerisation might help to release teachers' workload in preparing student reports. The innovation idea and the adoption of the HKSAS was entirely the Principal's alone and not shared with the staff. There was no attempt by the Principal to give a lead, and CAA was viewed as an unproblematic technical change. Neither the Principal nor the staff had sufficient understanding of the HKSAS - its capabilities and limitations, as well as its compatibility with existing working practice in the school. There was therefore no ownership on the part of the CAA people of the innovation nor much commitment for its success with the HKSAS package. They accepted the duty to attend the three-days training and the timetable module was used immediately afterwards in the summer holidays because the time was right for its introduction. The timetabling succeeded but not the other modules which were scheduled to be tried two months later.

When the student records and test/exam modules were attempted, incompatibilities with existing practices emerged. For example, the computer produced report cards had a format different from the school's traditional one, and the student data file could not store all the information that the school would like to keep for a student. There was not much consideration for possible adaptation on the part of the school's internal system of work, and requests to modify the HKSAS to meet the school's individual needs were not entertained by the software supplier. Support by the software house was thus considered unsatisfactory by the CAA team and use of the software was discarded except for the timetable module which was technically more difficult to operate. The CAA system supervisor also remarked that the office staff, who had no experience with computers, found it a burden to use the student data management module. Probably due to a lack of commitment to learn and make it work, they found data-input an extra load during the trial period for the secondary one students in addition to their manual system of record keeping for the entire school.

From his experience in the ILEA CAA pilot project, Watts (1985) has remarked that it was found difficult to judge a software until it was tried in the working environment. The YKH case in Hong Kong illustrated a similar difficulty. There were three more points to be noted from this YKH case about implementation. First, inopportune training could just be a waste of resources. A three-days training without follow-up trial and practice at work immediately afterwards was not an effective way to learn to about operating a CAA system. Second, lack of ownership and commitment for success on the part of participants could easily lead to their retreat when faced with problems; particularly during the trial period when extra effort and time were needed unavoidably. This is why, in the writer's opinion, that Fullan (1991) has stressed the importance of subjective meanings and a learning attitude on the part of participants for successful implementation of an innovation. Third, adaptation on the part of the organisation and its people was unavoidable. It would be naive to assume that a CAA system could meet with all the needs and existing practices of a school. The Principal of a school should be understanding and should provide sustained support during the innovation process. In particular, he/she would be the person in the capacity to judge what internal adaptations were required to assimilate the innovation.

NPC: The absence of an initiation phase in this school has been explained in Section 7.6.1. There was not a CAA team formed at the beginning. Individuals were assigned by the Principal to use different modules of the HKSAS. The Dean of Studies was in charge of timetabling and became the user of that module, while the school secretary took charge of all the rest. The timetable module was successfully implemented after initial training but not the others.

The school secretary had her own difficulties using the pupil records module. With the help of a part-time staff specially hired during the summer holidays, a large number of student data had been entered when another staff (not identifiable because the computer was used by other staff for word processing too) accidentally erased the whole thing. There were no backup discs for the student data. Much effort was spent on data re-entry, but the

module could not function properly still. After negotiations with the HKSAS supplier, the whole system including hardware and software was sent to the company for trouble-shooting. The printer was found to be incompatible and irregularities were found in the pupil data file due to programming errors when the module was expanded to meet the school's requirements. The company took some time to readjust the system but not long after that, the school secretary happened to find another job and left NPC. Subsequently a CAA team headed by the Dean of Studies was formed and the three members had to undergo a training session by the company, at the school's cost. In NPC, the HKSAS used was an IBM version with modifications on the pupil records module specifically requested by the school. The system was run on an IBM compatible machine with a printer that the school purchased from a company different from the HKSAS supplier. These might technically have caused the added problems during implementation and there was also mistrust generated between the software supplier and the school. As the Principal remarked,

"I suspect Mr. L is not happy that we didn't buy the hardware from his company. He is not supportive enough when we have problems. It takes a long time for him to come to help."

The NPC case reflected several issues which can impede the implementation of an innovation. Superficial and short-term training was one problem, similar to the YKH case. Another issue was that responsibility delegated to a single person without on-the-job support would be risky. The secretary of NPC was understandably quite heavily stressed to shoulder the responsibility of systems supervisor. Though she had a general computer training before taking up her job, she was not experienced in school administrative work and the use of CAA. Thirdly, a lack of planning for trial by stages, particularly when the software had not been field-tested completely (the student data module in NPC had been modified on request), could lead to possible frustrations. Finally, schools needed to prepare for possible staff mobility and a CAA team approach could safe-guard continuity better than assigning responsibility to an individual like the secretary in NPC. In the ILEA CAA pilot project, the points just discussed had been identified with a striking similarity.

There was one further problem identified in the study that was common to all HKSAS users, and perhaps applicable to all standard packages commercially produced too. This may be called the 'black-box' dilemma. Because the HKSAS is a fairly large software system, consisting of over one hundred and eighty programmes and a hundred data files, its architecture, design, and logistics are very complicated. All the programmes and major data files are encrypted for security and data protection reasons. HKSAS users can only understand its input-output operations but the internal process is transparent. This 'black-box' effect leads more likely to operation errors by the users. This is a 'black-box' dilemma because programmes and data file-structures are not released by the software supplier to the user for two major reasons: (1) to safeguard the interest of the software supplier; (2) if users were allowed to write their own programmes to access the data files, whether for modifications or additions, it would be difficult to trace the source of error when irregularities occur. Responsibility then would be confusing between the software house and the user.

HKSAS users therefore did not have total control over the system, nor the autonomy to adapt it to suit individual needs by themselves even if they have the expertise to do so. The software house has the total authority in this particular area.

In school SMC the decision to adopt the HKSAS system was made in mid-1987, marking the beginning of the implementation phase. Instead of the HKSAS supplier, the researcher took up the responsibility of training and support for the software operation and management. Hardware support, however, was still vested with the company. On the job training and continual operation support became the major role of the researcher during this phase of the innovation process. By March 1990 when the research came to a close, CAA was seen by SMC staff to have become a routinised regular operation in the school.

A different approach to training and support was taken in SMC by the researcher, in contrast to the other three schools. Instead of training the CAA team to use the system in one shot within a few days, the members of the team learnt to

use different modules as they put them into practice at the school. In other words, timing of the training given was matched to the job activities on the school calendar. The strategy employed was demonstrate-practice-feedback (Joyce, 1986) as explained in Section 6.6.2, much similar to the approach of do-review-learn-apply in experiential learning (Dennison & Kink, 1990) discussed in Section 3.11.2. The CAA group received on-the-job training and support as they worked, and problems encountered were explained and solved on-site by the researcher with the people involved. The group then trained other teachers and staff where and when necessary.

Two levels of skill requirements were found necessary for smooth application of the CAA system in the school. The lower level is for operation only and involves staff learning how to use the application software, including the HKSAS and other software like word processing. This level was not difficult to achieve by the school teachers and clerks in SMC who picked up quite readily with training done internally by the CAA group. In SMC, a small operation guide book had been produced specifically for this purpose.

The higher level of skill requirements is for management. These are skills that a CAA system supervisor needs to administer properly the whole system (both hard and soft wares) and this level is more technical. The CAA supervisor must have some basic computer knowledge, and has to be trained to understand the overall running of the HKSAS system. To guarantee smooth operation of the CAA system, a number of maintenance tasks have to be done by the CAA supervisor at appropriate times and these are transparent to the lower level users. Such tasks include, for example, system set-up, data file initialisation, file archive and backup, and file re-organisation at year-end. In short, the system supervisor has to know when to do what.

The researcher paid particular attention in SMC in training the CAA supervisor for the higher level of skill requirements which she needed. To minimise the 'black-box' effect (earlier discussed in this section) on the part of the CAA

supervisor, major inter-relationships among the different modules and data files in the HKSAS were explained to her. She could therefore work with an understanding of what effects different functions of the system would incur.

When SMC built up her student data-base, the clerk input a zero for the letter 'O' in a student's name without realising the difference for computers in contrast to ordinary typewriters. That student's record could not be retrieved subsequently when the correct name was keyed in. Such an unanticipated operation error took the system supervisor and the software company quite some effort and time to identify. On another occasion, the printer was found faulty by the clerk -- only to be discovered later that it was just a loosened connection of the printer cable.

Thus the CAA supervisor needs skills in trouble-shooting and problem-solving. When something goes wrong with the CAA system, the supervisor has to identify what the problem is. It is often not easy to identify why a system breaks down. There are hardware reasons, software bugs, or operation errors. Problems arise most often during the initial period of the implementation phase, when both the supervisor and other users are inexperienced with the CAA system.

Writers on educational innovation, like Fullan (1985, 1991) for instance, have often stressed that an innovation process is essentially a learning process for the organisation and the participants. The following rather lengthy quotation from the system supervisor of SMC suffices to justify this claim:

"From the very beginning when you started the innovation with us, I have always felt it a worthwhile project. I had decided to put in several year for it. That's why in the initial stage I often stayed in at school working late till six or seven in the evening, testing and playing with the computer. Despite difficulties at times, I have found it worthwhile all along. I know that CAA can make the whole running of the school smoother and faster. As I had expected, computerisation increases efficiency. Work is more streamlined with it, and there is possibly saving of effort on my own part as a teacher. Those were my expectations and reasons why I quite willingly accepted the responsibility as the system supervisor, because I'll be benefited too in the end. During the transition period, the only investment is time, particularly

when I was not familiar with the system at the beginning. But I felt all right, knowing well that I am learning something new and useful. The whole thing has been a learning exercise for me. Besides administering the system, another thing I have found is that I have developed myself to be better-tempered, or is it patience? It's really strange - I am sure I have a much better temper now than before. I used to be quite frustrated and ill-tempered when I could not do something right. But the computer has taught me to withhold myself by prompting error messages whenever I made mistakes. With the role of the system problem-solver, I knew well that I could not lose control when faced with problems or mistakes, else everything would be messed up and colleagues would not co-operate with me if I lost my temper. So no matter how frequently they made operational errors, I still made no complaints. I would feel upset sometimes of course, but I definitely would not show it on the spot. Whenever a problem comes up now, my first reaction is not to blame but to ask the people what they have done and show me through the steps they have taken, so that I can identify the errors they have made. Then I would think through the problems to see if I could come up with a solution, if not, I would contact you or the system house. This is something quite interesting. It wasn't my way of doing things before I became the system supervisor. I used to be quite harsh to students before when I saw something wrongly done - a bad thing about me as a teacher. But now I've changed even in my teaching. Even if a student breaks something in a laboratory now, I would not start by blaming her but rather look more into what had happened first. I have learnt much in problem-identification and this is something I am very happy about. It is a growing up for myself - a development of my personality." -- System supervisor in SMC.

In the view of the writer, the success of the CAA innovation in SMC could be attributable to a large extent to the learning attitude and perseverance of the system supervisor.

In summary, a number of key points can be drawn from the study for the implementation phase of the CAA innovation in Hong Kong schools:

- (1) innovation provides a learning experience for the participants;
- (2) a learning attitude is needed for participants of an innovation to make it successful;
- (3) training and support are crucial elements for successful implementation;

- (4) opportune and on-the-job training for CAA is more effective than pre-service one-shot training;
- (5) 'demonstrate-practice-feedback' is a practicable and successful training strategy for CAA;
- (6) CAA supervisors need problem-solving skills;
- (7) minimising the 'black-box' effect for the CAA supervisor can avoid major operation errors and thus increases the chance of success.

In this section a successful process of managing a school's CAA innovation has been reviewed, together with discussions on the strategies employed. Initiation and implementation are the key phases required before an innovation can be institutionalised.

'Implementation' is such a common term and a crucial one used in innovation that any writer on the subject would find it almost impossible to avoid. Thus Section 7.6.2 is titled 'The Implementation Phase' in discussing the stages of the innovation process that follow the 'Phase of Initiation'. The use of this term probably bears a close relation to the choice of the title 'change agent' widely used. Both terms, however, carry unfortunately a misleading implication in the management of educational innovations -- that innovations are something that can be implanted into an organisation by some agent. This line of thought is naturally followed by much concentration on resistance to change and ways of overcoming it. With such a classical perspective, 'change agents' are typically people employed by the management to 'implement' something new (and not welcoming probably) into the organisation. However, this study has found that a more humanistic approach may be more appropriate in managing school innovations. With a people-oriented approach that emphasises meanings of the innovation to the actors concerned, there is a better chance of success. The primary role of a change manager is helping people to learn during the change process.

In their Concerns-Based Adoption Model (CBAM), Hall (1987) and her colleagues use the term 'change facilitator' rather than 'change agent' that more

vividly describes the role which this subsystem should play. According to Hall & Hord (1987),

"... facilitation is, indeed, the task about which we are talking. The term agent suggests a power-invested, one-way, coercive/manipulative approach to change that from our research and experience, appears to be unreasonable and impossible. The facilitator's job is to facilitate, which means to assist others in ways relevant to their concerns so that they become more effective and skilled in using new programs and procedures." (Hall & Hord, 1987:11)

What these writers have said can be borrowed as a summary of the researcher's role during the implementation phase of the CAA innovation in SMC. Furthermore, this study on CAA innovation has found evidence much in line with the basic assumptions of CBAM, which include:

- (1) Understanding the point of view of the participants in the change process is critical.
- (2) Change is a process, not an event.
- (3) It is possible to anticipate much that will occur during a change process.
- (4) Innovations come in all sizes and shapes.
- (5) Innovation and implementation are two sides of the change process coin.
- (6) To change something, someone has to change first.
- (7) Everyone can be a change facilitator. (Hall & Hord, 1987:8-10)

Literature reviews note that many educational innovations often fail because they lack proper attention to implementation (Doyle & Ponder, 1977; Brown, 1980; Hurst, 1983; Morris, 1986), and the case of Cambire School is a classical example (Gross, Giacquinta, & Bernstein, 1971). The cases of YKH and NPC in this research fall into the same category. In the writer's view subsequent to the study, *implementation* is better replaced by the term *assimilation* in describing the phase that follows initiation in the process of a school innovation. Assimilation spells out more clearly the concept of an innovation being absorbed into a system, with a change facilitator system catalysing the process, rather than the traditional view of an innovation being implemented in it by a change agent.

In the following section, the whole process of an innovation is presented as a summary of discussions in the previous two sections. The tentative model of an innovation process developed in the light of the writer's ILEA experience (described in Chapter 6) was revised to a post-study model - the 'SIX-A Model', a label that is self-explanatory by looking at the stages involved during the process.

7.6.3 THE "SIX-A" MODEL OF AN INNOVATION

The main concern in this model is the process of utilisation by individual schools of an innovation system created and developed externally, with a change facilitator system (either internal or external) managing the process. The process is cybernetic with feedback channels and consists of six broad stages:

- (1) Awareness
- (2) Attitude Formation
- (3) Adoption
- (4) Adaptation
- (5) Action
- (6) Application

These stages are in fact interrelated and overlapping, and can be grouped into three main phases: the first being the *initiation phase* including awareness, attitude formation, and adoption; the second being the *assimilation phase* including adaptation and action; the third being the *institutionalisation phase* including action and application. The model of the whole process is a non-linear one and consists of re-cycling loops as illustrated in Figure 7.1 on the following page.

(1) The Initiation Phase

The initiation phase is the transition from the state of knowing that an innovation exists to the state of making a decision for adoption (or rejection),

involving stages of awareness and attitude formation on the part of relevant subsystems. Details about the initiation phase have been discussed in Chapter 6 and are not repeated here, except that as a result of the six months period of initiation for SMC, three different levels of adoption is discerned: adoption of idea, adoption for trial, and adoption for practice.

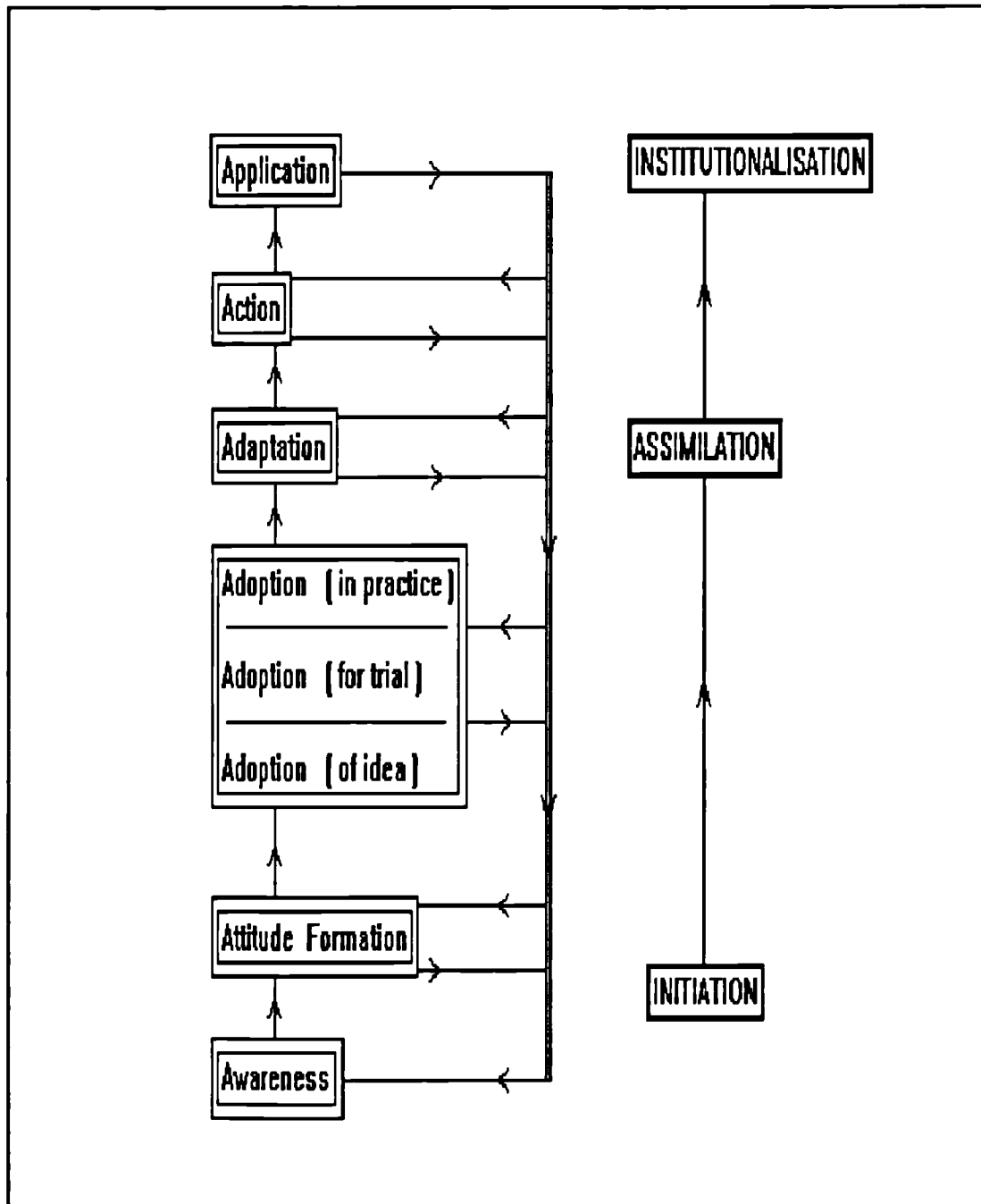


Figure 7.1 The SIX-A Innovation Model

The events that took place during the initiation phase in SMC has been described in Section 7.4. As an illustration, the 'Six-A' model can be used to interpret the re-cycling process among the stages of awareness, attitude formation, and adoption during the initiation phase of the innovation. Starting with the awareness about the possible use of the microcomputer in accounting matters, the school's accounting clerk searched for information and made contact with the writer. With better understanding of the feasibility the attitude of the clerk became positive towards the innovation. She personally adopted the idea and brought it up to the Principal and Supervisor of SMC. The latter people who represented the decision-making sub-system of the school went through the similar stages of knowing and understanding about the CAA innovation (not just about accounting); getting interested; and adopting the idea. The Principal then shared the idea with her teachers and a CAA team was formed to look into the matter further. The school finally adopted the CAA innovation, again only after this CAA team had gone through the three stages. This stage of adopting the innovation by the school, as the writer observed, was adoption for trial only. Because even after purchasing the HKSAS system, the CAA team of SMC only decided to try the modules one after and other first before putting them into practice for the whole school. Thus only the senior form students' report cards were computerised in the first year of implementation.

It is simply a sensible and natural way to assimilate something new by adopting on a trial basis before adopting for practice. With enough experience and learning through action using the innovation system, the innovation can be applied in full with confidence.

To recapitulate, adoption of an innovation can be divided into three levels:

- (1) the lowest level (level 1) is the adoption of an idea about a certain innovation, with a decision to search for more information, knowledge, and understanding for further consideration;

- (2) level 2 is the adoption of the innovation on trial, and marks the beginning of the assimilation phase;
- (3) level 3 is the adoption of the innovation in practice -- with the gaining of enough confidence, knowledge and skill, the innovation is put into action in real practice.

(II) The Assimilation Phase

The assimilation phase includes adaptation and action by the user system. It is immaterial whether adaptation precedes action, or the reverse. It is a cycle of events after the user system has adopted the innovation for trialing. It is a phase of experimentation for the user system in essence. When the innovation is used in the real life situation within the organisation, reactions or feedbacks from different subsystems within the organisation will lead to two kinds of adaptation possible:

- (1) adapting the innovation to meet user system requirements, i.e., tailoring or modifying the innovation system to meet the organisation's need;
- (2) adaptation on the part of the user system to suit the innovation system, i.e., modifying existing subsystems within the organisation (such as structures, tasks, habits, etc.) to achieve compatibility with the innovation system.

These two kinds of adaptation are not mutually exclusive and both are often required together. As an illustration of the first type of adaptation, all the CAA system supervisors of the schools interviewed had expressed their wish to be able to modify the HKSAS to match some of their school's individual needs. Such modifications might be simple as the format of the pupil report printout, or a little more technical like adding an extra data-field in the student personal record file. Unfortunately the 'black-box' dilemma that was explained in Section 7.6.2 prevented such adaptations of the innovation system. It was for this reason that YKH gave up the HKSAS except for the timetabling module (see Section 7.5).

As for the second type of adaptation, schools using CAA unavoidably had to change some aspects of their past practices. Forming a group to take charge of CAA, for instance, was a simple adaptation in structure. Centralisation of entry of marks by the CAA group as in WTS was a shift in allocation of duties. In this regard, Section 6.3 has explained in detail the relationship between the target of change and the other sub-systems of the school.

It is worth mentioning perhaps that feedbacks during the assimilation phase are not limited only to the adaptations and actions taken. In effect the degree of awareness and attitudes of people in the user system are also unavoidably affected as a result. Thus the whole process of innovation is an interrelated one, although a breakdown of it into component stages is required for discussion here.

The role of the change facilitator during this phase of the change is one of training, support, and problem-solving in practice. The recommended approach is one of theory-demonstration-practice-feedback (see Section 6.6.2). The prime objective is to help and guide the user system in assimilating the innovation, i.e. in getting accustomed to using the innovation, gaining confidence and achieving with it.

(III) The Institutionalisation Phase

Learning by action consolidates the participants' skills and confidence in using what originated as an innovation. When the user system on its own can finally apply the innovation system in routine operation, gaining the benefits originally set out to be achieved, institutionalisation is said to be reached, marking the end of the whole innovation process.

In the case school SMC, the modules of timetabling, teacher substitution, student data management, and examination results management were all assimilated within three years. Except for the accounting module which was not used (see Section 7.5 & 7.7.11), the CAA innovation may be considered as institutionalised.

7.7 MANAGEMENT CONCERNS IN CAA

In the previous section the interpretation of findings is concentrated on the process of the CAA innovation, and the 'SIX-A' model is developed as a result by revising the tentative model put forward in Chapter 6. It addresses the key research question formulated in Section 6.7 -- the applicability of the tentative innovation model for CAA innovation in Hong Kong secondary schools and how could it be enhanced. The practicability of the model has been demonstrated in the SMC case and in the light of the field work, some enhancement has been made to the model.

In this section managerial concerns and problems specific to the CAA innovation in schools are discussed. The two year CAA pilot project in ILEA revealed a number of factors (both barriers and supporters) specific to this innovation (Section 6.2). Issues covered in the following discussion include a number of aspects concerning the CAA innovation: funding and resources, objectives, training, structural changes, conflicts, leadership, and the like. To give a systematic presentation of these interrelated factors, Leavitt and his associates' (1973) framework is used. It has been explained in Section 6.3, using Leavitt et al.'s (1973) framework, that the introduction of an innovation into a school unavoidably has impact on its four organisational dimensions of task (objectives included), technology (resource included), structure, and people. CAA is no exception and the following sections report on the findings about the impacts of this technological innovation in schools in these four broad areas. There is no argument that most of the factors can go under different headings for discussion; furthermore, they are intertwined.

Findings and interpretations are centred around data collected from the case school SMC. Where appropriate, data collected from the other three schools (using the instrument in Annex C) WTS, YKH, and NPC are included for contrast and comparisons ('triangulation' as explained in Section 5.4).

7.7.1 TASKS & OBJECTIVES OF CAA

Intended & Achieved Benefits

In the ILEA CAA pilot project which is described in Section 6.2, the pilot schools generally recognised that "CAA was more efficient, more effective, more accurate and less time consuming over the manual method in administrative work". Much the same benefits were reported by the four Hong Kong schools studied. All of them considered that time savings for teachers and office staff, accurate and efficient data storage and retrieval were the intended objectives of their CAA innovation. The degree of achieving benefits varied among the schools.

In SMC there was a need to reduce the number of office staff in 1986 when the government imposed tighter financial control of administration grant for aided schools. The Principal adopted the CAA idea as a solution to this problem in 1987, in the hope that computerisation could help to ease the work load in the office. Earlier suggestions by her teachers in 1985 for CAA did not materialise but nevertheless had influenced the awareness of the Principal about the possibility. Then the school accountant Sister B triggered the innovation after her visit to the researcher's school (see Section 7.4).

Saving of clerical manpower was quite definite in SMC with a reduction from nine to six office staffs between 1987 and 1989. No change in staff number was found in the other three schools WTS, YKH, and NPC in connection with CAA. It should be emphasised that in SMC, staff-cutting was not a consequence of CAA but the innovation helped to absorb workload on the part of both office and teaching staff.

"We used to have our teachers' marks and calculations checked by the office after examinations, there is no such need now with CAA" -- in SMC

"Using word processing, our clerks can save about half an hour per letter because our principal often makes amendments to her writings" -- in NPC

Saving of teachers' time in handling examination marks and preparation of student report cards was identified in all the four schools. Accuracy and efficiency of data storage and retrieval were also reported. No accurate figure could be given by the schools in time savings but NPC estimated that at least two hundred man-hours per year could be saved on the part of the form-masters alone.

All the four schools reported that there was saving of time and manpower in preparing the school timetable. Only one senior staff was required to complete the job in about four days instead of involving a team of three or four senior teachers. Moreover, no manual checking and typing were needed afterwards by the clerical staff.

It should be noted that time and manpower savings are valid only when certain operations have become routinised. Actually, additional resource was needed during the transition period when the participants have to put in extra time and effort to learn how to use the computer systems. There were also other less tangible benefits besides time savings and efficiency, including staff of the schools learning new skills, as well as gaining experience in managing a school innovation.

No particular change or shift of objectives was identified in the CAA innovations of the four schools. A common spin-off of the innovation, however, was that computer awareness was raised among both teaching and non-teaching staff in the schools. Word processing in English and Chinese was quite commonly used by staff in these schools. The Principal of YKH installed a new IBM microcomputer in his room in 1989, and the Principals of SMC and NPC made the effort to attend computer courses, even though both were quite computer 'illiterate' when they started the CAA innovation in their schools.

"Our Principal doesn't know really what we are doing. According to what I have noticed and observed so far, she has never approached the computer and has never touched it" -- CAA system supervisor in SMC

"More teachers now use computers at home. Some went to courses too, 'not to be outdated', as they said" -- CAA system supervisor in SMC

In Section 3.11.3 about 'Change & People', it has been pointed out that people love change and they like to be refreshed (Gilbreath, 1990). Most people do not want to become 'outdated'. The CAA innovation when properly managed can induce staffs in a school to learn about a new technology and to become more receptive to new things. From a different angle, it may be argued of course that this is but an example of what Lancaster (1986) has described as 'technology pushed' effect.

Satisfaction or Dissatisfaction

Interviewees in the four schools were asked to rate their general satisfaction with the CAA innovation, as well as on hardware and software used in their schools on a 5-point scale: *very unsatisfactory, unsatisfactory, acceptable, satisfied, very satisfied*.

SMC was satisfied in general with CAA and with the hardware. However, it rated the software only as acceptable because of inadequate flexibility in some parts of the system - especially for certain time-consuming validation checkings and fixed-format printouts.

WTS was in general satisfactory with CAA and with the software but rated the hardware only acceptable because it had the experience of a breakdown of the computer monitor which cost over two thousand dollars to replace.

YKH rated the HKSAS software package as very unsatisfactory, except for the timetabling module which was considered satisfactory. After using self-developed software, however, CAA became acceptable for the school, except that program development was too slow and time-consuming because the two teachers involved could work only in their spare time.

NPC was dissatisfied with its CAA in general. The level of application was below expectation and the hardware was found unsatisfactory too because it was not a truly IBM compatible machine. The systems supervisor of the school remarked as follows:

"The cost of CAA was over HK\$70,000. But it is now doing the job of a low cost computer. The software is not fully utilised" -- in NPC

To check the degree of institutionalisation of the CAA innovation in the four schools, the question of how their schools would have been affected if the computer system broke down for a week was raised with the interviewees. NPC was least affected in such a situation, because it had not fully computerised its student records at the time of study. WTS, YKH, and SMC all responded that their school could not function normally; nor would it be in chaos. The computer was valued most by all these schools during reporting times after examinations -- the period reported that they would least want to see the system break down. Without the software facility during such periods, teachers would have to do student reports again manually. The general feeling of the systems supervisors was that the schools would be hampered either moderately or seriously, depending on how long their teachers have enjoyed the computer facility.

In spite of their varying levels of satisfaction and difficulties encountered, all four schools reported that they wanted to continue with CAA.

In view of the above and the popularity of CAA in about 80% of local secondary schools (Fung, 1991), it can be quite confidently concluded that CAA is a welcoming innovation to teachers generally in Hong Kong. The general attitude of the pilot schools in ILEA was similar (see Section 6.2). In the opinion of the writer, local teachers are glad that CAA can help to release them from some of the clerical routine jobs like calculating marks, preparing student reports, or copying students' data files. The climate in the teaching profession in Hong Kong over the past few years has been one of grudging too much time to non-teaching duties. CAA is thus a welcoming aid to the majority of teachers. There is another reason, in the writer's view, that CAA is not resisted by most teachers in Hong Kong. Because CAA is not directly interfering with classroom activities, there is no threat to teachers in this innovation in contrast to, say, innovations in curriculum or teaching methodology.

The level of satisfaction about CAA, as responded by the four schools, was thus dependent on the software, hardware, as well as on the level of application. The 'black-box' effect (see Section 7.6.2), inflexibility of software, and lack of autonomy to adapt or modify the system were major cause of dissatisfaction to the schools.

7.7.2 RESOURCE & TECHNOLOGY FOR CAA

Funding for the Innovation

All the four schools financed the innovation using their private funds. There was no government funding nor support for CAA in any way. In SMC, a fund-raising project for parents' contribution was launched specially for CAA using the opportunity of celebrating their 15th anniversary.

The initial cost of the HKSAS software and hardware was in the region of HK\$70,000 and the recurrent annual expenditure for hardware maintenance was around ten per cent of the initial cost. Only NPC but not the other three schools had contract maintenance for their hardware and incurred only repair costs when the system broke down. None of the schools entered into contract maintenance for their software. This phenomenon is different from the common practice in business firms which usually have budgets for maintenance contracts for computer hardware and software. Consequently, the HKSAS software company provided system-support to the schools only on a goodwill basis after a six-month warranty period and such free service was found unsatisfactory by the system supervisors of the schools. To acquire better hardware and software support, the writer suggests that schools adopting CAA should seriously consider the question of providing a budget for system maintenance.

System Breakdowns & Lessons

In all the four schools except YKH, data loss due to unsteady electric power supply was a bitter experience and the importance of making backups for important data was learnt by the staff as a result. SMC and NPC had to install a dedicated power line for the computer while WTS made use of a stabiliser.

"After the power failure we spent at least nine hours of hard work to re-enter the data just because we didn't have the backup" -- in SMC.

From the above as well as the writer's own experience in his school, it appears that making backups of computer data files is something often overlooked by new CAA users, particularly when there is a lack of understanding about the logistics in the software. When users are ignorant of when a certain function would make major changes to their data files, they overlook the importance of making backups before operating that function. Systems supervisors should therefore be trained to know when and what to backup. CAA users should be taught to prepare for the worst -- a few minutes for backup can save long hours of hard work.

Competition of Resources

The only incident noted in SMC when competition for computer resources occurred was in the first year of CAA operation in 1987. It was the first time teachers in the school had to enter marks into the computer and a large chart was put up for teachers to book their time-slots. The timetabler of the school wanted to do her job during the same time rather than in the summer vacation. As she was much more senior than the system supervisor, she had her way despite objections from the latter. No such conflict was found in the other three schools, because the system supervisors were all in the position of either Deputy Head or Dean of Studies. Of course such conflicts due to competition of resources could have been avoided if schools were to be able to afford enough computers.

As far as the researcher could observe, the timetabler in SMC was uncertain about using the computer to do the school timetable the first time in 1987. Her lack of confidence and anxiety probably prompted her to get access to the machine as early as possible just to be sure that a timetable could be produced. In case anything went wrong, as she told the researcher afterwards, she could still work on it manually during the summer holidays as in the past. Her attitude subsequently changed after successfully completing her task using the HKSAS Timetabling Module that year. No more conflict of the kind came up in later years when the timetabler confidently worked on the timetable during the summer holidays with confidence. This was an

illustrative example of the re-cycling effect between the different stages of action, awareness, attitude formation, and adaptation in the Six-A model.

7.7.3 STRUCTURAL CHANGES & CAA

Structural Modifications

In school SMC, a CAA team had been set up at the start of the innovation with the computer teacher as the system supervisor. Responsibility was divided within the team matching the CAA functions. Similarly a CAA team of teachers was formed in school WTS very early on and headed by the Dean of Studies. No such team was formally organised in school YKH but the Dean of Studies put in charge of the job by the Principal found two teachers with computer expertise to assist him. In school NPC the Principal originally assigned the school secretary to take charge of the Student Data and Test/Exam Management modules and the Dean of Studies separately for timetabling. After the resignation of the secretary (see Section 7.6.2) the Dean of Studies took up the overall responsibility for CAA on his own initiative and invited a teacher and the laboratory technician with computer knowledge to assist him. This Dean of Studies of NPC, as he told the researcher, took up the challenge because he did not want to see the investment on CAA in his school wasted.

Other than the kind of re-organisation described, no significant change in the organisational structure of the schools was found. There was also no impact of CAA on the chain of command nor the span of control in the four schools that the system supervisors could identify. The systems of communication within the schools as far as the system supervisors could see remained much the same with or without the CAA innovation (see also discussion in Section 4.1, Area (5)). In the writer's opinion, this finding in the schools was attributable to the fact that the CAA systems use in Hong Kong schools was at the 'administrative' and not 'managerial' level (Lancaster, 1989). At the higher level of management information systems for supporting decision making, impact of CAA on communication within the school may be identifiable.

Job Content & Work Shift

The CAA system in the schools studied essentially involved only a job-to-job conversion from a manual to a computerised system. People originally carrying the responsibility for certain jobs learnt to do it with the computer. Help was drawn from the technical expertise of staff within the school, usually the computer teacher, or, as in NPC, the laboratory technician. The importance of having people in the CAA team with professional skills and or experience in managing change was never recognised by the schools themselves, as evidenced from the membership of all the CAA teams.

Shifting of work load had been noticed in schools WTS, YKH, and NPC for entry of test or examination marks. This had to do in part with the problem of insufficient resource. NPC, with only one microcomputer, centralised the work to its office staff. WTS and YKH both had the work taken up by their CAA group of teachers. In SMC, all teachers were trained to input their own marks on the computer, which was easier than using a calculator for tedious calculations.

No other major change in work systems or habits was found necessary in the four schools for CAA. Other than staffs and teachers directly involved with CAA, other teachers needed practically no formal training when the computer was introduced for administration purpose.

Status, Control, & Continuity

No change in the formal status of the teachers who took charge of CAA were reported in the schools. However, the informal authority or influence of these people had risen. Because of their expertise needed to oversee the smooth operation of the system, they had become more important to their school. Other staffs without computer knowledge or the training to administer the CAA system have to rely on the system supervisor in trouble-shooting and problem-solving.

The present level of CAA application in the four schools had not yet developed to the level of a management information system sophisticated enough to

affect decision making. However, the flexibility provided by CAA helped to make it possible, for example, for the schools to choose different mark-weightings for different subject papers -- something that a manual system would try to avoid because of the amount of work imposed on teachers.

In SMC, WTS, and NPC, standardisation of teachers' comments for student reports as a result of CAA eliminated the checking required formerly by senior teachers. In a sense, therefore, machine control had taken over human control. Other than this, no significant impact was found on task control.

Since the informal authority of a CAA system supervisor is boosted in a school due to his/her expertise as explained earlier, management should be aware of the possible side effects such as power conflicts within the school, or the problem of staff mobility. One pilot school in the ILEA case had invested £5,000 on CAA but the deputy head in charge of the system left and no one could succeed to operate it (Section 6.2). In the school NPC, a similar situation occurred when the secretary resigned (Section 7.6.2); and in the school SMC the accounting module was left unused after the accounting clerk was transferred to another school (Section 7.5). Therefore it would be unwise for a school to let its CAA system be reliant on a single person, and be faced with the serious problem of continuity when he/she leaves the organisation for one reason or another. After all, to provide continuity is one major benefit of computerisation as explained in Section 4.2, and this can only be achieved with a team approach in managing the CAA system. In this respect, Bird (1991) has suggested the same need for CAA team management in U.K. schools.

7.7.4 PEOPLE & CAA

Centralisation & Stress with CAA

As a result of CAA, it was found that all the schools studied had centralised their mark calculations and preparation of student reports. In this respect, teachers in general had been relieved from all their tedious work, and responsibility had shifted to either a small group of teachers or the office staff. However, stress had

increased consequently for the CAA people, in particular the system supervisor, about meeting deadlines for producing reports for the whole school and their common worry was "what if the computer breaks down when doing the reports?". Even if they had backups of data files, they worried that hardware breakdowns could not be repaired in time for their jobs.

On the other hand, stress had been lessened for the school timetablers using the computer timetabling module. For the experienced user, a conflict-free school timetable could be easily produced and printed in just a few days.

The use of CAA in a school therefore would cause a certain degree of centralisation and inadequate hardware support was stressful on the part of the system supervisor (see also Section 7.7.2).

Authority & Support

In SMC, the line of authority became less clear because of CAA. The system supervisor commented as follows,

"Before CAA, I was very clear about my job as a computer teacher. Now being the system supervisor, I am not clear about my authorities. Should I be directing other colleagues as to what they should do, leaving myself for the planning, or should I be involved in the actual carrying out of the works? I am pretty confused."

Implications for management are clear from this example. It should be recognised that the CAA innovation is targeted towards change in the technology subsystem of the school. This requires corresponding changes in the other three subsystems of task, structure, and people as well (see Section 6.3). The authority structure in the school SMC needed readjustment when the new position of system supervisor was created. The staff put into such a position has to be clear not only about the duties and responsibilities assigned, but should be given also certain authority to mobilise other staff members to support the innovation. Tasks of this kind executive functions delegated should in the opinion of the writer be made public to all of the staff in order to promote their collaboration. Such publicity is

particularly important when the people who have the responsibility of CAA system supervision delegated to them, are not originally holding any post with formal authority. This aspect was neglected in the case of SMC where the system supervisor had been with the school for only two years when she was given the responsibility to manage the CAA system. She was a junior compared to many other teachers in the school. She once expressed her difficulties and feelings as follows,

"My headmistress on one occasion said to me 'I don't really know what you are doing when you produce report cards with the computer. If anything goes wrong with the system, make sure you don't come to see me.' She might be joking on the one hand but I know she did mean it on the other. I can't express to her problems that arise at times, and won't ask her to allocate CAA related duties. Because other members in the CAA team are more senior, I just don't know my own feelings -- it's kind of uneasy when I ask them to do something, sort of I'm making an order to them. It is thus confusing."

The previous comment illustrates the culture which has a hierarchical system at its core in some Hong Kong schools. Seniority represents authority in this culture, whether that authority is formal or informal. Decision making within this hierarchical system in many schools rests with the principals and a few senior teachers. There is a lack of participatory management and a collegiate climate in many schools, thus EMB & ED (1991) have said in the 'School Management Initiative',

"Encouraging schools to become more effective requires motivating all those involved in delivering education. At present many teachers are isolated from the decision making process." (EMB & ED, 1991: 37)

The SMC case clearly reflected, in the opinion of the writer, that the CAA innovation did have an impact on the authority culture in the school. Teachers in the school should be encouraged to recognise that certain power shifts are unavoidable with the innovation and to respond in a positive way. In particular, the senior teachers should learn and adapt to a recognition of 'authority by expertise' although this is no easy matter, and is likely to be accomplished only over time. With a more open attitude and a collegiate team spirit, conflicts that might arise because of position or seniority can be mitigated or even avoided.

Support from the office staff was also found to be unsatisfactory by the CAA system supervisor in SMC as already explained in Section 7.6.1. The neglect of a relevant subsystem (the clerical staff in this case) during the initiation phase had created undesirable effects in the assimilation phase. Because CAA is likely to bring about certain change in job content of people in the school, the jobs of involved parties (teachers versus office staff in SMC, for instance) must be clearly delineated and allocated to avoid confusion or misunderstandings in carrying out the tasks associated with CAA.

Leadership in CAA

Senior management support has often been pointed out as a necessary factor for innovation success (see Section 3.11.5). Such support is required throughout the whole process of the innovation, particularly from the Principal. The Principal does not necessarily have to be the person with the expertise to manage the innovation, or be directly involved in the day to day operation of related activities. Responsibility delegation is necessary but this is not abdication. The Principal is the figurehead with the vision of where the school is going. He/she is looked upon for care and spiritual support for the innovation in the minimum. He/she is the person who should be aware of and attend to conflicts. Delegation of responsibility is not abdication. Leadership is particularly important especially during the transition period of uncertainty in a change process (see Section 3.11.5 on Change & Leadership).

One piece of evidence from the study serves as an illustrative example in support of the above discussion. In the four schools studied, only WTS was successfully using the accounting module of the system. In SMC, the apparent reason for not using the module was due to a staff change - the school accounting clerk who was initially interested in computerisation left for another school. (She is a catholic sister and was transferred to another school under the same religious body for reasons unrelated to CAA). However, the fundamental reason not to use the accounting module, as the researcher observed (in YKH and NPC as well as in SMC), was a lack of commitment by the Principals to put the module into practice. There was no demonstration on the part of the Principals to see effects using that module. In other

words, the Principals did not take up the role of what the writer calls a 'change effector'. A change effector is someone on top with the authority to influence others by saying "Let's make it a success" or "Let's make it work". He/she is the one who wants to see effects with the innovation. When the Principals were content with accounts manually done, the message was easily picked up by the staffs. The natural result was that the accounting module was simply left quietly untouched in the computer.

Generally teachers in Hong Kong secondary schools are seldom involved with school accounting matters. Though in some schools the department heads may be responsible for annual budgets for their own subjects, only the Principal and the accounting clerk can have the overall financial information about the school. It is rare to find any school in Hong Kong where the allocation of financial resources is open to the whole teaching staff. Thus all the system supervisors in the schools studied were not concerned with the accounting module in the HKSAS system. They could not assume the role of the change effector in this case for the Principals, as they did for the other modules in the HKSAS. The following comment is indicative of the situation,

"I think that we do not use the accounting module because our Principal doesn't want us teachers to know about the financial details of the school. Only the clerk in charge of accounting should handle it; and since she is new and uninterested to do it on the computer, our Principal just let her do it manually." -- system supervisor of SMC.

This specific example indicates loud and clear that success of an innovation needs a change effector - someone who cares and would want to see it work. Lack of leadership and expectation from the head is readily recognised by others whose effort towards the innovation would then also be minimal. For much the same reasons, YKH abandoned the HKSAS except for the timetable module, wasting much of the initial investments.

Training & Learning

Much has been discussed in Sections 7.4 and 7.6.2 about operational training of the HKSAS package in the school SMC and the other three schools WTS, YKH,

and NPC. Details about this critical factor in the assimilation of the CAA innovation by schools are thus not repeated here. It is necessary, however, to highlight the 'demonstration-practice-feedback' (Joyce, 1986) training approach, with sessions scheduled matching the implementation stages of the different modules for action, that was used by the researcher in SMC. This approach was markedly different from the three-days 'one-shot' training provided by the software supplier to the other three schools. The former approach to training was found more effective and successful for the CAA innovation. Time and effort needed, however, were naturally much more on the part of both the trainer and the learners. To guarantee a better chance of success for the innovation, the writer is of the opinion that such investments are unavoidable.

This argument is based not only from the empirical evidence of the study but also on the theory that innovation is a learning process and not an event, as Fullan (1985, 1991), Turrill (1986), and others have advocated (see Section 3.11.2). The writer would like to add a few more general points in this regard. First, technical training to develop the skills to handle the innovation system (for example, operating the HKSAS modules) is necessary but not sufficient. More importantly, however, is the 'training' or development of the participants for the capacity for change, and also their understanding of the dynamics of change (Reid et al., 1987:12). Given that leaders and participants in educational innovations understand and accept that change is a learning process on their part, they are more likely to appreciate the subjective meanings (Fullan, 1991) of one another about an innovation; more likely to change their attitudes; more likely to commit their time and effort; more persevering in problem-solving; and thus more likely to benefit themselves and their schools in the end. The Six-A model developed in the thesis hopefully might contribute some help in this direction.

CHAPTER 8

CONCLUSIONS AND DISCUSSIONS

8.1 IMPLICATIONS FOR CAA IN HONG KONG

It would be difficult, if not impossible, to find strong arguments against the trend of using computers in schools to assist administration and management, in Hong Kong as well as in other parts of the world. The level of CAA application in Hong Kong only so far reached the 'datalogical' rather than 'infological' stage, with functions chiefly for administrative routines and not for supporting managerial decision-makings. The concept of decision support systems (Fisher et al., 1990) is nowhere to be seen yet in the school sector. Schools are working only on their own initiative and the central government has no CAA policy or support so far.

Changes are anticipated to be forthcoming, however. The following recommendation from a most recent report (The School Management Initiative issued by the Education and Manpower Branch and Education Department) setting the framework for quality in Hong Kong schools in the years ahead is a strong piece of evidence:

"ED should obtain expert help to define the information needs of the schools education programme and develop appropriate management information systems. ... The recommendations in this chapter will lead to a range of management information needs in schools and ED very different from that which is now available or thought desirable by managers. There must be an urgent re-appraisal of these needs." (EMB & ED, 1991:34)

One other indication is that microcomputers for administrative purpose are now included in the standard equipment list for new schools. Another piece of information, through communication between the writer and a senior official in the Hong Kong Education Department, is that a budget of near to 29 million Hong Kong

dollars has been allocated between 1991 to 1995 to equip all primary and secondary schools with a microcomputer each for CAA. Unfortunately, no planning or budget for developing software for school users is included. Internally, the Education Department is on its way to computerisation. A Central Information System Branch has been set up within the department in 1989 and funds amounting to 16 million Hong Kong dollars have been secured to develop its education information system.

The vision of the Education Department is to link up its 19 district offices to a central mainframe computer to enhance its present communication system that uses paper files. Moreover, data collected and held presently by individual sections within the department (such as the pupil records section, the accounts or statistics sections) can be shared in future without duplication of efforts. With its own mainframe, the department will be able to handle also the allocation of pupils to schools at primary one, secondary one, and secondary four without relying on the government's central computer service. A turn-key system will also allow individual schools to hook up to the department's mainframe in future to access and download relevant data for school administrative purposes, as well as receiving departmental circulars through electronic mailing.

The blueprint described is an attractive and ambitious one, but the planning of this large scale educational innovation lacks a holistic view. It attends only to the needs of the central education department, without taking school users into account. In this regard, the Hong Kong Education Department's approach to CAA is incidentally similar to that of the NYSSCSS of New York (see Section 4.3.1) in the mid-1980's, quite unlike the U.K. post 1988 experience.

8.1.1 FORESEEABLE PROBLEMS

The lack of an integrated approach in the planning and design of CAA systems, particularly on a district-wide scale, is risking much opportunity cost. Following the Education Department's present line of thought, a centralised information system is to be developed for its own administrative and management

functions, while schools will be given microcomputers and are expected to develop their own systems on their part. Schools will be encouraged to share and exchange their developed CAA software and they are expected to tele-communicate with the department in future. While there is no compatibility problem for the hardware provided, there is serious doubt on the compatibility of the software developed by individual schools to the centralised information system.

Uniformity versus flexibility is a major problem in CAA. The core of the question is well formulated by Visscher (1991) as follows:

"How to develop a system that can be used in as many schools as possible?" Often a friction exists between on the one hand the goal of developing a system for many schools and on the other hand taking care as much as possible of the unique characteristics of each school. The first goal should result in the development of a uniform system for a large number of schools. The second goal is meant to produce a system that takes care of the differences between schools and of the varying information needs of managers. The IS (Information System) should be so flexible that it can satisfy specific information desires and support activities that are carried out only in a limited number of schools. In fact a contingency approach is needed." (Visscher, 1991)

Standardisation to a certain degree of CAA software in schools is necessary for data to be communicable to the central office, and vice versa. If there is no initiative on the part of the local education department to lead in this direction, several problems can be envisaged in the years ahead:

- (1) it is doubtful whether individual schools have the ability and expertise to develop reliable CAA software to the datalogical level, not to mention the infological ideal;
- (2) even if they can, individual schools will be wasting resources in duplicating efforts to develop CAA software - 're-inventing the wheel' as it is called in the United Kingdom;
- (3) self-developed software usually depend on a single or limited number of staffs within the school for proper operation, and mobility of such members will be detrimental to the administration of the school;

- (4) given hardware and software, schools still need facilitation to assimilate the innovation, as this study has shown;
- (5) if schools are left to venture on their own with CAA, the future state in Hong Kong will be similar to the situation in the United Kingdom in the mid-1980's, as described by Watts:

"The main thrust towards CAA, using microcomputers, originated in the schools and as such was, almost inevitably, amateur, ad hoc, not easily generalised, bug-ridden and unintegrated. ... Similarly, experience in Local Education Authorities (LEAs) has also proved extremely haphazard." (Watts, 1985:2)

A recent survey has reviewed that around 85% of secondary schools in Hong Kong now use some form of administrative computing (Fung, 1991). Compared with data collected eight years ago when the figure was only about 22% (Fung, 1983), the magnitude of CAA in Hong Kong has increased much indeed over the past few years. The majority of Hong Kong secondary schools now uses the computer as an administrative tool. Without central leadership, the present situation of CAA in Hong Kong is probably not far off 'a can of worms' as Bird (1984) warned the LEA's in the U.K. then.

If the matter is still left unattended until the central information system of the education department is set up in two to three years' time, tremendous effort will be needed to convert individual school data files for compatibility. Schools will also be resistant to give up their programs in use, or to run an additional system just for supplying information to the centre. The objective of networking schools with the central education department will then be defeated.

Besides technical problems regarding software development and compatibility among schools, one other equally important aspect that needs central leadership in CAA is often overlooked. This is the provision of training for managerial skills to 'implement' the innovation in the schools. In Section 7.6.1 of the thesis, one of the major conclusions drawn is that the CAA innovation process needs proper management to be successful. The central education department has to recognise this, rather than assuming that schools in the territory can be computerised just by provision of the hardware and software.

8.1.2 RECOMMENDATIONS

There are at least three distinct roles that the Central Information System Section (CIS Section) of the Education Department should take up in this territory-wide CAA innovation. The first responsibility is to oversee the development, probably by external professionals, of software to be used by the central office as well as by schools. The second role is that of a change facilitator in guiding the potential user system (including subsystems like different sections within the education department and schools) through the innovation process. The third role, which will be required during the change process as well as in the long term, is providing training and support to the user system.

The CIS team of people should therefore not only have technical knowledge, skill, and experience with computers, but also similar expertise in the area of innovation management.

An integrated approach that takes into account the relevant subsystems, including schools as well as different branches within the education department, is recommended for the CIS Section in this challenging project towards a computerised central information education system for Hong Kong. In this regard, a plan for managing the whole innovation process should include four different phases:

- (I) Creation/Developmental Phase
- (II) Initiation Phase
- (III) Assimilation Phase
- (IV) Stabilization/Institutionalisation Phase

The objective of Phase (I) is to develop an integrated software system with two main subsystems, one for the central and the other for schools. For simplicity these will be labelled respectively CEMIS (Central Education Management Information System) and SAMIS (School Administration & Management Information System), denoting the ideal of an infological level and not just datalogical in the future systems. It is not intended here to go into details about design objectives of the

system, but it can be anticipated that such a system will use probably a fourth-generation language, such as ORACLE that is used in the SCHOLIS project of the Netherlands (Visscher, 1991).

An in-depth survey of existing CAA situation in schools should be done as soon as possible. This to ensure that updated information about the existing state of affairs in schools is available for planning further action, such as the degree of training and support necessary for the innovation on a territory-wide basis. Such an exercise will also review the software packages commonly in use already in schools, including commercial packages for word processing, database, spreadsheet, as well as CAA software like the HKSAS.

The CAA software package that is identified to be most commonly used in schools should be adopted as the 'interim standard'. Possibly the HKSAS that is already in use in about thirty schools is the one, but that is subject to the finding of the survey proposed. In any case, it is proposed that a prototype CAA package should be chosen and recommended to schools as a standard during the SAMIS developmental phase which will probably last for two to three years. At the same time, two things should be done to develop this prototype: (1) enhancements according to users' feedback, and (2) alignment with CEMIS which will then be in the process of design and programming. Alignment means making additions of data fields to the prototype that the central office would like schools to keep and supply in future. Moreover, as SAMIS is going to replace the prototype in future, utilities should be prepared for conversion of data files in the prototype to fit in with SAMIS as well when it is being designed and programmed. There are several advantages in this strategy:

- (1) making use of existing available resources, rather than starting from scratch in developing the innovation system;
- (2) channelling potential school users into a common standard instead of uncontrolled individual developments, and with planning for conversion to SAMIS, will save much future effort in standardisation;

- (3) schools can enjoy CAA benefits using the prototype (though only 'satisficing' compared with SAMIS) without waiting for a long developmental period of time;
- (4) user participation in SAMIS design, in the form of feedbacks about the prototype, derives commitment and support for SAMIS -- a crucial element of innovation assimilation.

If the above strategy is accepted, then the initiation phase can be carried out in parallel with the developmental phase. The objective of the initiation phase is to raise the awareness and attitudes of user systems towards the innovation. The 'School Management Initiative' (EMB & ED, 1991) has recommended to start an SMI pilot project in September 1991 with fifty secondary schools in Hong Kong. The new framework for school management will be tested in the pilot and it is strongly recommended here that a pilot CAA project should be incorporated simultaneously into the participating schools.

The following approach can be taken to solve, at least in part, the standardisation-flexibility problem (Section 8.1.1) and the black-box dilemma (Section 7.6.2). When the prototype CAA package is disseminated to schools, a utility program should be accompanied which will serve to convert all data files into text (i.e. ASCII) format and put into a subdirectory in the hard-disc. In other words, a duplicate set of data files originally handled by the prototype package is made accessible to school users if they so wish to. While individual schools should stick to the rule that they do not write their own programs to access the original standard core of data files, they are encouraged to add-on or write programs to suit their own needs with the duplicate. Since the duplicate data files are in text format, they can also be easily transferred to be used with commercial packages like database or spreadsheet. This will open up a developmental path for individual interested parties while integrity of the prototype, and in future the SAMIS too, is guaranteed.

Furthermore, pilot schools should each form a CAA team that will be trained by the central CIS Section. These piloting CAA teams will serve several functions

and they should be trained as trainers and not just for system supervision for their own schools. They will first have to train and support other staffs within their own schools in CAA. Furthermore they are responsible for feedbacking about operation and enhancements for developing the SAMIS. They will be encouraged also to develop, if possible, additional programs operating on the duplicate set of data files which other pilot schools can share. Lastly but not the least, they will form a network of users whose experience can be drawn to train and support future users when the project is extended to all other districts in Hong Kong.

This framework has many advantages, including:

- (1) allowing individual school autonomy yet achieving uniformity;
- (2) training of trainers is more efficient and effective when the target group of schools will number over four hundred just in the secondary sector;
- (3) experienced users are usually better trainers than technical people;
- (4) a network of users who can mutually support one another can save a lot of central effort;
- (5) staff mobility problem which might affect individual schools can be easily attended to with help from the network.

Such a pilot CAA project for fifty schools will take at least two to three years to complete. When all the pilot schools have gone through the phases of assimilation and institutionalisation, the development of CEMIS and SAMIS should by then reach a launchable state and the innovation can then be extended to cover the whole territory.

The writer has biased the discussion so far on the part of user schools because this is the subsystem likely to be neglected. The CIS Section will probably take care of other subsystems like different sections within the education department and the district offices. However, as any change facilitator managing this territory-wide computerisation scheme will appreciate, much of what has been said are also applicable to these user subsystems just as to schools.

8.2 IMPLICATIONS FOR EDUCATIONAL INNOVATIONS & RESEARCH

It was pointed out in Chapter 5 that the research intends to generate rather than to test a theory. Out of the first ILEA case study, together with support from available literature, a tentative model for managing the innovation process of CAA was formulated for Hong Kong. This was put into action in a school in Hong Kong with success. This model for change was revised and expanded as the research proceeded, and presented as an example of an innovation model in Chapter 7. This addressed the first major research question formulated in Section 6.7. The proposed Six-A model of innovation has both a descriptive and a prescriptive flavour. It would be naive to suggest that this model applied to one school with success is necessarily generalisable, but it can certainly help to illuminate the practice of school administrators who intend adopting computerisation. As shown in Chapter 7, an innovation does need to be managed (is this not common sense?) for a better chance of success. Thus it would be helpful for an administrator to have at least one model or framework in mind rather than none to assist an effective and efficient adoption of CAA.

A phenomenological perspective as Fullan (1991) has suggested (see Sections 5.1.3, 6.6.1, & 7.6.3) is recommended for managing school innovations through two key phases: initiation and assimilation. In essence, innovations are not so much activities planned and implemented in schools; they need to be assimilated with deliberation on the part of people subsystems within the organisation. This recommendation to use the action approach which emphasises the meanings of participants in managing school innovations needs further elaboration with particular reference to the educational culture in Hong Kong.

It has also been mentioned in Section 1.1 that the culture in most Hong Kong schools is one of conforming selectively to rules and regulations. Systems needs are the prime concerns for most educational administrators, and the fact that 'people' are important subsystems in organisations is often overlooked or even ignored. Under such a systems orientated culture, decision making is commonly centralised at the top,

participation by teachers is minimal, and authority structure is hierarchical (see Section 7.7.4). Thus educational innovations in Hong Kong, just like the INSET as explained in Section 3.12, are implemented typically with the centre-periphery or top-down model. Drawbacks of such an approach in implementing change has been discussed in detail in Section 3.11 and are not repeated here. It is necessary though to point out that to be more successful in the management of school innovations, local educational administrators need a 'cultural shift' towards the people orientated dimension .

The management concerns of the CAA innovation in a Hong Kong school, particularly during the transition period of change, were the other research questions to be addressed. The findings have been detailed in Section 7.7. Compared to issues identified in the ILEA CAA case study, many of the implementation problems of CAA in local schools were found similar. Some of the findings were specific to CAA; others could be generally applicable to managing school innovations. How applicable or transferable are they to other school innovations is a question that the writer would leave open. In connection with the management of a school innovation such as CAA, major findings of the study are recapitulated below:

- (1) lack of ownership and commitment for success could easily lead to participants' retreat when faced with problems;
- (2) adaptation on the part of the organisation and its people is unavoidable.
- (3) innovation provides a learning experience for the participants;
- (4) a learning attitude is needed for participants of an innovation to make it successful;
- (5) training and support are crucial elements for successful implementation;
- (6) opportune and on-the-job training for CAA is more effective than pre-service one-shot training; inopportune training could just be a waste of resources;
- (7) 'theory-demonstrate-practice-feedback' is a practicable and successful training strategy for CAA;

- (8) CAA supervisors need problem-solving skills;
- (9) minimising the 'black-box' effect for the CAA supervisor can avoid major operation errors and can thus increase the chance of success.

Discussion about the management of innovations in this thesis are unavoidably concentrated on its main theme - computer aided administration, CAA. The relevance or applicability of the findings to other educational innovations is an area open for further research. It is worth mentioning though that the model for managing the CAA innovation is generated both from grounded work experience as well as from the works of many other researchers that cover a wide spectrum of educational innovations.

Within the writer's own school, for example, a number of innovations have also been successfully introduced over the past few years, basically following the Six-A model. Enhancing the school organisational structure for better communication (Fung, 1989) was one of these. 'Project ABLE' (Fung et al., 1991) which involved innovation on junior secondary curriculum and teaching method was another ('ABLE' stands for 'A Better Life Education'). It is not intended to make the claim that the model proposed is applicable to all educational innovations and/or different institutions, but some parts of it are hopefully transferable with adaptation.

More research, particularly along the lines of case studies and qualitative methods, will help to accumulate our knowledge about the process of educational innovations and help us run better schools. In respect of the area of educational management information systems, this study has been able to touch upon only a limited institutional portion. Even within that small region the impact of the computer on the organisation, for instance, could not be covered in depth. The writer thus shares much the view of Stenhouse in calling for the effort

"that we develop in our field a better grounded representation of day-to-day educational reality resting on the careful study of particular cases" (Stenhouse, 1979:10).

8.3 EPILOGUE

In a packaged tour, everything can be pre-planned and arranged before starting the trip. Practically all information needed for the journey is available and certain in advance. The tourist-guide is someone usually experienced in the route and 'has been there before' for all the destinations. His/her task is simply one of following an itinerary and to see that members in the tour are well looked after.

In an exploratory adventure, planning and arrangements before setting out are of course needed. Total information will not be available for the journey and provisions for contingency are of particular importance. Members of the adventure team share some common goals, although they have their personal interests and expectations from the venture. Participants are committed to making the trip successful. With problem-solving and learning attitudes, they are willing to contribute their efforts and expertise when needed. The team leader's role is not one of directing and controlling, but rather co-ordinating and perhaps attending to conflicts at times. He/she preferably should be experienced in explorations or else advice and consultancy can be sought from a facilitator invited to join the team.

Managing an educational innovation is like leading an exploratory adventure, rather than guiding a packaged tour.

ANNEX A
FRAMEWORK FOR CASE STUDY IN ILEA CAA

I. CONCEPTUAL

- [1] Innovation**
 - [1.1] Type**
 - [1.1.1] Curriculum**
 - [1.1.2] Functions**
 - [1.1.3] Roles**
 - [1.1.4] Organisation & Administration**
 - [1.2] Formalisation**
 - [1.2.1] Deliberate**
 - [1.2.2] Better**
 - [1.2.3] Whom**
 - [1.3] Objectives**
 - [1.3.1] Political**
 - [1.3.2] Crisis/Response**
 - [1.3.3] R & D**
 - [1.4] Initiation**
 - [1.4.1] Initiator**
 - [1.4.2] Change Agent**

II. ENVIRONMENTAL

- [2] Context**
 - [2.1] System**
 - [2.1.1] Sub-systems**
 - [2.2] Conditions**
 - [2.2.1] Constraints**
 - [2.2.2] Supports**
 - [2.2.3] Climate**
 - [2.2.3.1] Regional**
 - [2.2.3.2] Schools**
 - [2.2.3.3] Others**

III. THEORETICAL

- [3] Model**
 - [3.1] P-R-D-D**
 - [3.2] Others**
 - [3.3] Strategies**
 - [3.3.1] Empirical-rational**
 - [3.3.2] Normative-re-educative**

- [3.3.3] Power-coercive
 - [3.3.X.1] External
 - [3.3.X.1.1] Political
 - [3.3.X.1.2] Economical
 - [3.3.X.1.3] Social
 - [3.3.X.1.4] Technological
 - [3.3.X.2] Internal (Target)
 - [3.3.X.2.1] Structure
 - [3.3.X.2.2] Task
 - [3.3.X.2.3] People
 - [3.3.X.2.4] Technology

IV. PRACTICAL

- [4] Phases
 - [4.1] Problem Identification
 - [4.2] Planning
 - [4.3] Development
 - [4.4] Experimentation
 - [4.5] Evaluation
 - [4.6] Dissemination
 - [4.7] Implementation
 - [4.Y.1] Barriers
 - [4.Y.1.1] Taxonomy
 - [4.Y.1.1.1] Structure
 - [4.Y.1.1.2] Task
 - [4.Y.1.1.3] People
 - [4.Y.1.1.4] Technology
 - [4.Y.1.2] Direction
 - [4.Y.1.3] Conflicts
 - [4.Y.1.3.1] Interest Groups
 - [4.Y.1.4] Sub-strategies
 - [4.Y.1.4.1] Role Change
 - [4.Y.1.4.2] Re-distribution of Power

V. TECHNICAL

- [5] System
 - [5.1] Hardware
 - [5.1.1] Configuration
 - [5.1.2] Alternatives
 - [5.2] Software
 - [5.2.1] Configuration
 - [5.2.2] Alternatives
 - [5.2.3] Development

ANNEX B.1

The following is a list of CAA applications produced by the Minnesota Educational Computing Consortium (Haugo 1981) after conducting a study of feasibility and interest in administrative users of the microcomputer in school districts of Minnesota in 1979:

Student:

1. Athletic Eligibility list
2. Attendance (annual)
3. Attendance (daily)
4. Class Records
5. Census (family)
6. Enrolment Projection
7. Graduate Follow-up
8. Guidance Records
9. Health Records
10. Instructional Management
11. Mark Reporting
12. Scheduling Assistance
13. School Calendar
14. Student Records
15. Test Scoring Analysis

Personnel:

1. Paycheck Calculation
2. Payroll Reporting
3. Personnel Records
4. Salary Simulation
5. Staff Assignments

Facilities:

1. Energy Management
2. Facilities/Equipment Inventory
3. Facilities Utilisation
4. Maintenance

Finance:

1. Accounts Receivable/Payable
2. Activity Accounting
3. Financial Forecasting
4. Food Service
5. General Accounting
6. General Accounting
7. Investment Accounting
8. Vendor Reports/Purchase Orders

General:

1. Activity Scheduling
2. Ad Hoc Reporting
3. Bus Routing
4. Information Storage and Retrieval
5. Library Circulation
6. Media Reservations
7. Mailing Lists/Labels
8. Project Planning and Budgeting
9. Statistical Analysis
10. Snow Removal Schedule
11. Word Processing

ANNEX B.2

A list of CAA applications reported by Spuck & Atkinson (1983):

Student Applications

- 1. Student Scheduling**
- 2. Grade reporting**
- 3. Grade and transcript information**
- 4. Daily and summary attendance accounting**
- 5. Student and family demographic information**
- 6. Health records**
- 7. Instructional management**
- 8. Test scoring and summary information**
- 9. Tuition and fee statements**

Personnel Applications

- 1. Payroll checks and deductions**
- 2. Personal records**
- 3. Staff assignments**
- 4. Certification records**
- 5. Health records**
- 6. Tax information and reports**

ANNEX C

INTERVIEW GUIDE

(This semi-structured interview guide is adapted from Whisler's (1970) and expanded for use in schools)

Purpose of the Interview Guide

The guide is designed to help in several ways:

- * To ensure that every interview covers the same areas in all schools
- * To aid the interviewer in asking questions in the same manner in all schools
- * To give respondents advance notice of areas to be discussed and facts required by presenting all information requirements in advance in schedule form

Interview Questions

** The questions refer specifically to
the use of computer in school administration --
CAA (Computer Aided Administration) in short **

Names of schools and persons interviewed will be confidential and findings used only for purposes of the research.

NAME OF SCHOOL:

INTERVIEWEE:

POSITION:

Date of Interview:

The researcher will start off with a brief self-introduction and explanation about the purpose of the research, affirming confidentiality of names of interviewee and anonymity of findings. Some general information about interviewee's (1) personal background, and (2) knowledge about computers pre- and post- the CAA innovation will be asked. The interview will be tape-recorded.

(This checklist is to be used in conjunction with some questions in the interview guide)

CHECKLIST

	<----- Sections and question number ----->											
Application of Function	O	I		III		IV		V				
	T	E	F	G	A	B	E	F	A1	A2	B	F1 F2

- a. Student Records
- b. Test/Exam Marks
Handling
- c. Student History
Records
- d. Timetable
Construction
- e. Teacher Leave
& Substitution
- f. General
Accounting
- g. Word Processing
- h. Library
Maintenance
- i. Staff Records
- j. Student Reports
- k. Statistics
Reports (Internal)
- l. Statistics
Returns (to External Agencies)
- Other
(Specify)
- m.

0. CAA (Computer-Aided-Administration) At Your School.

- A. What were the objectives/purposes/motives of the CAA innovation at your school?
- B. Who determined these objectives?
- C. Which of the objectives have now been achieved? How do you know they have been achieved? (Any success criteria).
- D. Are there any other spin-offs? Any change or shift of objectives so far?
- E. Was there any model of planning being followed for the CAA innovation at your school? If yes, what was it?
- F. Can you identify clearly any one or all of the following stages in the process of introducing CAA at your school? (Indicate as accurately as you can the period of time taken for the different stages identified and the key people involved).
- (i) Awareness (?months ?who)
 - (ii) Attitude Formation (?months ?who)
 - (iii) Decision Making (?months ?who)
 - (iv) Trial Implementation (?months ?who)
 - (v) Sustained Implementation or institutionalization
 - (vi) Other stages (Please specify)
- G. Which stage of the change process has been reached currently? How do you know? e.g. any indicators.
- H. How was CAA funded at your school, including initial costs and recurrent costs.
- I. How satisfied are you in general with CAA at your school?
- *.....*.....*.....*.....*
- very unsatis- acceptable satisfied very
unsat. factory satisfied
- Can you explain why?
- J. How satisfied are you with the present software system?
- *.....*.....*.....*.....*
- very unsatis- acceptable satisfied very
unsat. factory satisfied
- Can you explain why?

- K. How satisfied are you with the hardware system?
*.....*.....*
 very unsatis- acceptable satisfied very
 unsat. factory satisfied
 Can you explain why?
- L. As a consequence of CAA, have you found stress (in general terms) in your work
 (i) decreased? (Please explain)
 (ii) increased? (Please explain)
 (iii) remained more or less the same?
- M. Do you prefer not to have CAA if given a choice? Why?
- N. List the benefits of CAA you can identify to your school.
- O. What major problems have you encountered in the CAA innovation?
- P. If you were to start all over again with CAA, how would you plan for the innovation?
- Q. If your CAA system is not working completely for a week, would your school be
 (i) in chaos?
 (ii) seriously hampered?
 (iii) moderately hampered?
 (iv) functioning as normal?
 Which organizational unit would be most affected? Least affected?
- R. During which period of the year would you least want the system not to be working?
- S. Have you had breakdowns of the CAA system? Where? Which part? What happened? What was the result? What was learnt?
- T. If you have to cut a function (i.e. a task or module of the software) from your existing CAA system, which one would you pick? (Use checklist and please explain your choice).
- U. Do you have any functions in mind to add to your existing CAA system?

I. Historical

- A. When was the computer first introduced into your school?**
(Repeat information for each generation of hardware)
(Date of feasibility study start and finish)
(Date of computer installation)
(Date of first parallel run)
(Date of first on-line run)
(What machine was used?)
- B. Who in the school made the initial proposal for installation? What stimulated his interest?**
(Computer salesman, professional meeting, articles, personal background, influence from other schools?)
- C. Who supervised the feasibility study? If any.**
- D. What kinds of senior management support were given to the CAA innovation? Who and at what stage?**
- E. What functions were put on the computer first?**
(Use checklist.) Any reasons for the choice?
- F. What functions are now computerized ?**
(Use checklist.)
- G. What functions will be computerized within the next six months? (Use checklist.)**
- H. How much money was invested on hardware? software? Give an estimate (as accurately as you can) of the average current monthly expenditure for the computer system and peripherals?**

II. Organization Structure

- A. Who has immediate responsibility for CAA? To whom does he/she report? (If responsibilities are divided, please indicate.)**
- B. Has this allocation of responsibility changed? (If yes, please explain why) Will it?**
- C. Have any new departments/sections committees been created as a result of CAA introduction? Any old ones eliminated or modified?**

- D. What changes in the allocation of work/tasks have been made as a result of CAA? (i.e. shifting around of activities or people, e.g. clerical staff taking teachers' work)
- E. In which of those organizational units in which CAA has been applied has the chain of command (i.e. number of managerial levels) been shortened? Lengthened? Please give examples.
- F. In those organizational units in which CAA has been applied has the average span of control (i.e. number of subordinates reporting to an individual) changed as a consequence of this application? Please list the affected units, indicating whether this span of control has increased, decreased, or remained unchanged?
- G. In the organizational units in which CAA has been applied, have the numbers of personnel changed as a consequence
 - 1. at the clerical level? How?
 - 2. at the teacher and department head levels? How?
 - 3. at the deputy-head and school principal levels? How?
- H. In the organizational units in which CAA has been applied, are there any time-savings at
 - 1. the clerical level?
 - 2. the teacher and department head levels?
 - 3. the deputy-head and Principal levels?
 Please give an estimate if you can of the savings in man-hours per year to the different levels?

III. Authority and Control

- A. In which functions where CAA has been applied are decisions now being made at a higher level than formerly? (Use checklist.) Give examples.
- B. At a lower level? (Use checklist.) Give examples.
- C. In the context of your school's culture, do you feel that CAA has resulted in a closer (or looser) control and monitoring of individuals than formerly? Please give examples to illustrate why and how control changed as it did.

- D. Has machine control or monitoring in any way replaced/supported/impeded human supervision? Give examples.
- E. Has CAA led to a greater centralization of administrative control? (Specify in which functions, using checklist.)
- F. Has CAA led to a greater decentralization of administrative control? (Specify in which functions, using checklist.)
- G. Has CAA in any way not previously mentioned affected relationships between staff at different levels? Among people at the same level? Between management and teachers? (Please give examples)
- H. Have lines of authority become clearer/less clear/unchanged as a consequence of CAA? (Please give examples)

IV. Decision-making

- A. Has CAA helped to identify problems or areas for possible change? (If yes, please specify in which functions, using the checklist. If no, please explain why).
- B. Has CAA helped to quantify decisions that formerly were treated as "intuitive" or unquantifiable? If so, in which functions? Can you cite examples? Any success? (Use checklist.)
- C. Does CAA provide more/less flexibility in decision-making? Examples? (A vague question, intended to be open-ended)
- D. At what level of the organization has decision-making been most strongly affected by CAA (lower, middle, top management)? Have your deputy-heads and/or school head made any use of CAA systems? Give examples.

V. Job Content

- A. As a consequence of CAA (direct and indirect factors), for each department or section affected, has clerical jobs
 - 1. been routinized?
 - 2. been enlarged?
 - 3. remain unchanged?
 Can you cite examples?

- B. As a consequence of CAA (direct or indirect factors), for each department or section affected, has clerical jobs
 - 1. increased?
 - 2. diminished?
 - 3. remained unchanged?
 Can you cite examples? If you can recollect, at what stages of the innovation?

- C. As a consequence of CAA (directly or indirectly), for each department or section affected, has the number and variety of responsibilities of the individual managerial jobs
 - 1. increased?
 - 2. diminished?
 - 3. remained unchanged?
 Can you cite examples? What about at different stages of the innovation process?

- D. As a consequence of CAA (directly or indirectly), does the clerk now spend more, less, or about the same percentage of her time
 - 1. communicating with superiors?
 - 2. communicating with other clerks?
 - 3. working alone?

- E. As a consequence of CAA, have the skill requirements in general been upgraded/downgraded/affected at the following different levels:
 - 1. clerical level? what sort of skills?
 - 2. teacher level? what sort of skills?
 - 3. middle-management level? what sort of skills?
 - 4. top-management level? what sort of skills?
 At which level has the effect been the greatest/least?

- F. 1. In which function have the changes in skill requirements been the greatest? (Use checklist.)
 - 2. The least? (Use checklist.)

VI. Organizational Adaption

- A. Are changes brought about by CAA planned and executed by
 - 1. a committee? Who is on it (please specify status of members, e.g. clerk, teacher, etc)?
 - 2. the school head? Who advises him?
 - 3. another executive? Who?
 - 4. other? Explain.

- B. Have problems of organizational or personal adaption ever held up application of CAA? Describe an example.
 - C. Has any individual whose functions were affected by CAA been given any compensation or incentive? If yes, who and how?
 - D. Is there a problem of users competing for scarce computer time? If yes, what organizational arrangement (who is responsible, what rules are used) do you have for allocating scarce computer time to the competing demands of different users? Is the arrangement satisfactory? Do you know of a better one?
 - E. Describe the orientation and training programs, if any, related to introduction and use of computers that have been set up for
 - 1. top management
 - 2. middle management
 - 3. teachers
 - 4. clerks
 - 5. othersPlease describe the effect of the orientation and training for the above groups.
Is there or will there be any continued training?
- VII. Any additional remarks from the school on any issues not covered in this interview guide.

ANNEX D

FUNCTIONS AND FEATURES OF MODULES IN HKSAS

<1> *The STUDENT DATA MANAGEMENT module:*

<1.1> Functions

- (a) Stores and allows speedy retrieval on screen of updated and accurate student personal data.
- (b) A default file size for storing on-line 1500 student records. (Larger size can be used depending on school population and disc capacity).
- (c) Simple full-screen saving of amendments of student personal data.
- (d) Prints various pre-defined listings and reports conditionally and/or selectively.

<1.2> Features

- (a) On-line screen enquiry of any student personal data records
 - by name, or
 - by student number.
- (b) Caters for duplicate student names.
- (c) Automatic updating of class at academic year end on user-request with flexible selection.
- (d) On-screen validation of input data such as dates and minimum entries of fields for unique record creation.
- (e) User enquiry separated from record maintenance and report printing by different levels of userID.

<1.3> Input (Stored) Items (Some items are specific to Hong Kong)

Student Number	Student Name	Class
Sex	Date of Birth	Place of Birth
Nationality	I.D. Number	Religion
SSPA/JSEA No.	Band Code	House
Fee Code	Last School	Address
Telephone No.	Guardian	Relationship
Occupation	Office Tel. No.	Date of Entry
Class of Entry	Date of Leaving	Class of Leaving
Class Last Year		

< 1.4 > Printouts/Reports (sorted alphabetical/class order as appropriate)

Student Personal Records	House List
Class Name List	Attendance Register Details
School Leaver List	Class Mark Sheet
Repeater Name List	Leaving Certificate
Trial Promotion List	Student Address Labels
School Class-structure	Student Identity Cards
Age statistics Report	

< 2 > *The TEST/EXAM RESULTS HANDLING module*

< 2.1 > Functions

- (a) Stores and allows retrieval of internal assessments and examination results of individual students.
- (b) Stores and allows retrieval of teachers' comments on individual students.
- (c) Stores and allows retrieval of past performance of individual students since admission.
- (d) Updates class structure and student personal records at academic year end.
- (e) Transfers school leavers' records to floppy-discs at year end.
- (f) Calculates internal test and examination marks, averages, grades, ranks, etc. for automatic printing of reports to parents.

< 2.2 > Features

- (a) User defined subjects offered to different classes.
- (b) User defined grades look-up table.
- (c) User Choice of GRADE or MARK output on school reports.
- (d) Allowance of up to 3 terms in each academic year.
- (e) On-line screen enquiry with student number or name of any student's
 - current year performance
 - historical performance.
- (f) Item bank storage and retrieval of teachers' comments (a storage of up to 999 statements).
- (g) Item bank storage and retrieval of student participation in extra-curricular activities (a storage of up to 999 clubs or activities).
- (h) Simple year-end promotion and transfers.

- (i) Easy entry of test/exam marks, for single entry of subject, conduct, absence, comments, etc. or all items in one batch.
- (j) Both on-screen and print-out validation of entries.

<2.3> Inputs

Test and Examination Marks, comments, etc.
 No. of school days per term
 Subject look-up table
 Grade look-up table
 Teachers' comments item bank
 Extra-curricular activities item bank

<2.4> Printouts and Reports

Subject Reference Table	Summative Class Mark Sheet
Grade Table	Student Reports
Teachers' Comments Item Bank	Prize Winners List
Activities Item Bank	JSEA Return (To H.K. E.D.)
Analysis of Subject Pass %	Student Testimonials
Termly Master Mark Sheet	Student Transcripts
Annual Master Mark Sheet	

<3> *The TIMETABLING module*

Of all the modules in the HKSAS, this is the most interesting breakthrough of using computers in school administration. This module constructs the school timetable automatically according to a set of user-defined constraints. An achievement rate of about 95% completion in a single run is found with conditions in most Hong Kong secondary schools. The remaining part is left to be completed by human interaction with the computer with available fits and possible swaps between periods displayed on screen. The user is prompted to make decision about alternatives with over-riding of certain constraints when necessary.

<3.1> Functions

- (a) Constructs timetables automatically with human interaction added for completion.
- (b) Stores and allows retrieval of class-timetables, teacher-timetables, and room-timetables.
- (c) Stores and allows maintenance and retrieval of school calendar.
- (d) Prints above-mentioned timetables and also school master timetable.
- (e) Prints free teacher/room lists.
- (f) Forms the basis for teacher substitution or coverage.

<3.2> Features

- (a) Real computer scheduling.
- (b) Caters for a minimum of 70 classes/teaching groups, 99 teachers, 99 teaching locations.
- (c) Caters for 5-day week, 6-day cycle, or 7-day cycle timetables.
- (d) Allows a maximum of 10 periods per day with user-defined period interval structures.
- (e) Caters for single, double, and triple periods; paired classes and split classes.
- (f) Caters for laboratory or special room periods.
- (g) Allows pre-setting of any period on timetable before computer construction.
- (h) Permits reserves of teachers/locations for defined periods before construction.
- (i) Provides easy, fast, interactive and informative manual modifications of constructed timetables.
- (j) Better allocations than manually prepared timetables.

<3.3> Inputs

Basic School Information	Control Information
Teacher Constraints	Location Constraints
Subject Reference Table	School Calendar

<3.4> Outputs

Subject Reference List	Teacher List
Location List	Staff Deployment Analysis
Class Timetables	Teacher Timetables
Location Timetables	School Master Timetables
Free Teacher List	Free Location List

<4> The STAFF LEAVE/SUBSTITUTION (COVERAGE) module

<4.1> Functions

- (a) Keeps staff leave records.**
- (b) Keeps staff substitution records.**
- (c) Generates staff substitution slips automatically.**
- (d) Prints summary and/or statistics of staff leaves and substitutions.**

<4.2> Features

- (a) Caters for current date coverage and that of advance notice.**
- (b) Automatic lookup of teacher timetables according to date input.**
- (c) Caters for any number of staff absences (something unwanted by heads, perhaps!)**
- (d) Allows manual on-screen adjustments of substitutions before posting, if necessary.**
- (e) Fair substitution selection according to absent and substitution records.**

<4.3> Inputs

- (i) Staff on leave.**
- (ii) Date if different from system-date.**
- (iii) Staff to be exempted from substitution, if any.**

<4.4> Outputs

With user-defined range of dates -

Staff Substitution Slip	Details of Individual Leaves
Details of Substitution	Summary of Leaves & Substitution
Statistic of Leaves (For H.K E.D.)	

<5> The SCHOOL ACCOUNTING module

<5.1> Functions

- (a) Stores and allows retrieval of school accounting transactions.
- (b) Posts validated transactions to general ledgers.
- (c) Prints Income and Expenditure Statement.
- (d) Prints Trial Balance.
- (e) Prints Balance Sheet.
- (f) Automatic year-end transfers.

<5.2> Features

- (a) User-defined fiscal period.
- (b) User-defined chart of accounts.
- (c) User-defined statement formats and year-end transfer formula.
- (d) On-line enquiry of
 - journal transaction details between user-selected dates;
 - master accounts;
 - detail accounts;
 - trial balance.
- (e) Monthly budget setting & reference.
- (f) Last and current year's monthly accounts balances reference.

<5.3> Inputs

Chart of Accounts
Statement Definitions
Year-end Transfer Formula
Fiscal year starting date
Transaction data

<5.4> Outputs

Income & Expenditure Statement	Statement Definition Listing
Trial Balance Sheet	Charts of Accounts Listing
Balance Sheet	Journal Records
Detail Accounts Listing	Year-end Transfer Formula Listing

BIBLIOGRAPHY

Abraham,S. (1981)
'The impact of automated systems on the productivity of managers and professionals'
in *Proceedings of the 1981 Office Automation Conference*, Houston

Ackerman,L. (1986)
'Change management: basics for training'
in *Training and Development Journal*, April, pp67-9

Adams,J.L. (1987)
Conceptual blockbusting
Harmondsworth: Penguin

Adelman,G., Jenkins,D., & Kemmis,S. (1977)
'Re-thinking case study: notes from the second Cambridge Conference'
in *Cambridge Journal of Education*, 6, pp139-150

Allport,F.H. (1955)
Theories of perception and the concept of structure
New York: Wiley

Angyal,A. (1941)
'A logic of systems'
in F.E. Emery (ed.) *Systems thinking: Volume one*
Penguin Books Ltd, England, 1981, pp27-40

Argyris,C. & Schon,D. (1974)
Theory in practice: increasing professional effectiveness
San Francisco: Jossey-Bass

BCSSC. (1976)
'The use of the computer as a management aid in schools: a report'
The British Computer Society Schools Committee
in *Computer Education*, 23, pp13-17

Barnett,H.G. (1943)
Innovation: The basis of cultural change
McGraw-Hill, New York

Bartlett,A.C., & Kayser,T.A. (eds). (1973)
Changing organizational behavior
Prentice-Hall, Inc., Englewood Cliffs, New Jersey

Bate,P. (1984)
'The impact of organisational culture on organisational problem solving'
in *Organisation Studies*, 5, pp43-46

Bate,J., & Burgess,R. (1985)
The automated office
Collins, London

Beal,G.M., & Bohlen,J. (1968)
'Social action: instigated social change in large social systems'
in A.L. Bertrand & R.C. Von Brock (eds.) *Models for educational change*
Southwest Educational Development Laboratory, Austin, Texas

Beckhard,R. (1969)
Organization development: strategies and models
Reading, Mass.: Addison-Wesley Publishing Company

Beckhard,R. & Harris,R.T. (1977)
Organizational transitions: managing complex change
Reading, Mass.: Addison-Wesley

Bedfordshire Education Service. (1985)
Introduction to the schools information management system for the Bedfordshire education service: SIMS
Unpublished report May, 1985

Bell,D. (1980)
'The social framework of the information society'
in M.Dertouzos & J.Moses (eds.) *The computer age: a twenty-year view*
MIT Press

Bell, J. et al. (eds). (1984)
Conducting small-scale investigations in educational management
Harper & Row, London

Bennis, W.G. (1963)
'A new role for the behavioral sciences: effecting organizational change'
in *Administrative Science Quarterly*, VII, September 1963, pp144

Bennis, W.G. (1965)
'Theory and method in applying behavioral science to planned organizational change'
in *The Journal of Applied Behavioral Science*, 1965, pp337-360
Also in A.C. Bartlett & T.A. Kayser (eds.) *Changing organizational behavior*, Prentice-Hall: Englewood Cliffs, New Jersey

Bennis, W.G. & Nanus, B. (1985)
Leaders
Harper and Row

Bennis, W.G., Bennis, K.D., & Chin, R. (1969)
The planning of change
Holt, Rinehart & Winston, London, 2nd ed

Berg, P., & Bramble, W. (1983)
'Computers and the future of education'
in *A.E.D.S. Journal*, V17, n1-2, pp101-108
Fall, 1983

Bertalanffy, L. von. (1950)
'The theory of open systems in physics and biology'
in F.E. Emery (ed.) *Systems thinking: Volume one*, pp83-99
Penguin Books Ltd, England, 1981

Bicknell, J.E. (1964)
'Electronic data processing and the state department of education'
in D.D. Bushnell (ed.) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education
Association of the United States

Bird,P.J. (1984)
Microcomputers in school administration
Hutchison, England

Bird,P.J. (1991)
'Computer assisted school administration in England'
in *Computer assisted school administration & management: An international analysis, Journal of Research on Computing in Education*,
Volume 24, Fall 1991

Blake,R.R., Mouton,J.S, Barnes,L.B., & Greiner,L.E. (1964)
'Breakthrough in organization development'
in A.C.Bartlett & T.A.Kayser (eds.) *Changing Organizational Behavior*
Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1973

Blakesley,J.F. (1964)
'Applying computer technology to scheduling and related administrative problems'
in D.D.Bushnell (ed.) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education Association of the United States

Bluhm,H.P., & Visscher,A.J. (1990)
'Administrative computing in the USA and The Netherlands: implications for other countries'
in *School Organisation*, 10, (1), 1990, pp107-117

Bolam,R. (1974)
Planned educational change: theory and practice
University of Bristol, U.K.

Bolam,R. (1976)
Innovations in INSET: practice and theory
Paris, OECD

Bolam,R. (ed.) (1982)
School-focussed in-service training
London, Heinemann

Boswell,J. (1981)
'Management objectives - report on a new school management system'
in *Times Educational Supplement*, 13th Nov 1981, pp40

Boyle,R. (1985)
'Why wrestle with jellyfish? Lessons in organizational change'
in *National Productivity Review*, Spring, pp180-3

Brickell,H.M. (1961)
Organizing New York State for educational change
State Education Department, Albany, New York, 61-62

Broderick,W.R. (1968)
The computer in school
The Brodley Head, U.K.

Brown,S. (1980)
'Key issues in the implementation of innovations in schools'
in *Curriculum*, 1, pp1

Burke,W.W., & Schmidt,W.H. (1971)
'Primary target for change: the manager or the organization?'
in H.A.Hornstein et al. (eds.) *Social intervention: a behavioral science approach*
New York: The Free Press

Burns,J.M., (1978)
Leadership
Harper and Row

Bushnell,D.D. et al. (eds.) (1964)
The automation of school information systems
Department of Audiovisual Instruction of the National Education Association of the United States

Caffrey,J., President (1963-1964) of AEDS (Association for Educational Data Systems)
in D.D.Bushnell et al. (eds.) (1964) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education Association of the United States

Carlson, R. (1965)
'Barriers to change in public schools'
in R. Carlson et al. (eds.) *Change processes in the public schools*
University of Oregon: Center for the Advanced Study of Educational
Administration

Carnall, C.A. (1990)
Managing change in organizations
Prentice Hall International (UK) Ltd

Child, J. (1984)
Organization
London: Harper and Row

Chin, R. (1967)
'Some ideas on changing'
in R.I. Stiller (ed.) *Perspectives on educational change*, pp336-338
Appleton-Century-Crofts, New York

Clark, P.A. (1972)
Action research and organizational change
Harper & Row

Coleman, J.S. (1973)
'Conflicting theories of social change'
in G. Zaltman et al. (eds.) *Processes and phenomena of social change*
New York: Wiley Interscience

Conner, D.R. (1988)
'The myth of bottom-up change'
in *Personnel*, October, 1988, pp50-53

Cooper, C.L. (1987)
'Coping with stress'
in *Science and Business Link-up*, April, pp38-40

Crozier, M. (1964)
The bureaucratic phenomenon
Tavistock Publications and University of Chicago Press

Cuban,L. (1984)

'Transforming the frog into a prince: effective schools research,
policy & practice at the district level'
in *Harvard Educational Review*, 54, pp2

Dalin,P. et al. (1973)

*Case studies of educational innovation: IV-Strategies For Innovation
in Education*
CERI, Paris, OECD

Dalin,P. (1978)

The limits of educational change
London: Macmillan

Dean,N.J. (1961)

Management implications of total information systems
Paper for Systems and Procedures Association
Los Angeles: Booz, Allen, and Hamilton, Management Information System
Department, October

Dennison,B. and Kink,R. (1990)

Do, review, learn, apply: a simple guide to experiential learning
Blackwell Education

Doyle,W., & Ponder,G. (1977)

'The practicality ethnic in teacher decision making'
in *Interchange*, 8(3)

Easton,D. (1965)

'A systems analysis of political life'
in Open Systems Group (ed.) *Systems behaviour*, pp246-253
Harper & Row Publishers, 3rd edition, 1981

EMB & ED. (1991)

*The school management initiative: setting the framework for quality
in Hong Kong schools*
Education and Manpower Branch & Education Department, Hong Kong

EMIE. (1983)

*Administrative use of computers by local education authorities:
report of a questionnaire survey (as at 29 September 1983)*

Education Management Information Exchange, Society of Education
Officers, U.K.

Emery, F.E. (ed.) (1981a)

Systems thinking: Volume one

Penguin Books Ltd, England

Emery, F.E. (ed.) (1981)

Systems thinking: Volume two

Penguin Books Ltd, England

Esland, G. (1972)

Innovation in the school: unit 12 E282 - school and society

The Open University Press

Everard, K.B., & Morris, G. (1985)

Effective school management

London: Harper & Row

Farner, F. (1966)

'Computers in school management'

in J.W. Loughary et al. (eds.) *Man-machine systems in education*

Harper & Row

Fisher, J.C., Semrau, P., & Turban, E. (1990)

'Decision support systems in elementary and secondary education
administration'

in *School Organisation*, Vol. 10, No.1, 1990, pp91-105

Fothergill, R. (1981)

'The microelectronics education programme in the United Kingdom'

in J. Megarry et al. (eds.) *World Yearbook of Education 1982/1983:
computers and education*

Kogan Page

Fullan,M. (1973)
'Thornlea school, Ontario, Canada'
in *CERI Case studies of educational innovation, 3 - at the school level*
OECD, Paris

Fullan,M. (1982)
The meaning of educational change
New York: Teachers College Press

Fullan,M. (1985)
'Change processes and strategies at the local level'
in *Elementary School Journal*, 85, 3, pp391-421

Fullan,M., Miles,M.B., & Taylor,G. (1980)
'Organizational development in schools: the state of the art'
in *Review of Educational Research*, 50, 1, pp121-184

Fullan,M. (1991)
The new meaning of educational change
Cassell Educational Limited, London

Fung,A.C.W. (1983)
Secondary school administration assisted by a computer system: problems and prospects
M.Ed. Dissertation, University of Hong Kong

Fung,A.C.W. (1988)
'Trends and development in computer-aided school administration'
in *Proceedings of Microcomputers in Education Conference*, pp A20-28
Hong Kong

Fung,A.C.W. (1989)
'Enhancing the school organizational structure for better communication'
Paper presented at the annual conference for secondary school principals, December 1989
Hong Kong

Fung,A., Wai,C.K., & Lau, Y.N. (1991)
'Project ABLE: a case of school-based curriculum innovation'
Paper presented at the Eighth Annual Conference, Hong Kong Educational Research Association, November, 1991.

Fung,A.C.W. (1991)
'Computer assisted school administration in Hong Kong'
in *Computer assisted school administration & management: An international analysis, Journal of Research on Computing in Education*, Volume 24, Fall 1991

Galbraith,J.R. (1973)
Designing complex organizations
Addison-Wesley Publishing Co

Galbraith,J.R. (1977)
Organization design
Addison-Wesley Publishing Co

Gilbreath,R.D. (1990)
'The myths about winning over resisters to change'
in *Supervisory Management*, January, pp1-2

Giles,M., Gatlin,D., & Cataldo,E. (1974)
'The impact of busing on white flight'
in *Social Science Quarterly*, 55, no.2 (September)

Glaser,B., & Strauss,A. (1967)
Discovery of Grounded Theory
Aldine, Chicago

Goldsmith,W. & Clutterbuck,D. (1984)
The winning streak: Britain's top companies reveal their formulas for success
London: Weidenfeld and Nicolson

Griffiths,D.E. (1964)
'Administrative theory and change in organizations'
in M.B. Miles (ed.) *Innovation in Education*
Teachers College, Columbia University

Gross,N., Giacquinta,J.B., & Bernstein,M. (1971)
*Implementing organizational innovations: a sociological analysis of
planned educational change*
Harper International Edition

Grossman,A. (1964)
'The school information system'
in D.D.Bushnell (ed.) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education
Association of the United States

Guba,E.G. (1967)
'Development, diffusion and evaluation'
*Paper prepared for the University Council for Educational
Administration Career Development Seminar, Portland, Oregon, October
1967*

Guba,E.G. (1968)
'A model of change for instructional development'
*Paper prepared for the Educational Media Conference, Indiana
University, 25 June 1968*

Hall,A.D., & Fagen,R.E. (1956)
'General Systems'
in L.von Bertalanffy & A.Rappoport (eds.) *Yearbook of the society for
the advancement of general systems theory*
Ann Arbor: Braun-Brumfield

Hall,G.E. & Hord,S.M. (1987)
Change in schools - facilitating the process
State University of New York Press

Hamblen,J. (1964)
'Total system information systems design for a university'
in D.Bushnell et al. (eds.) *The automation of school information
systems*
Department of Audiovisual Instruction of the NEA of the U.S.A

Hamilton,D. et al.(eds). (1977)
Beyond the numbers game
Macmillan Education

Handy, C. (1984)
Organizations
2nd ed., Harmondsworth: Penguin

Hargreaves, D. (1984)
Improving Secondary Schools
Report of the committee on the curriculum & organisation of secondary schools, London ILEA

Haugo, J.E. (1981)
'Management applications of the microcomputer: promises and pitfall'
in *AEDS Journal*, V14, n4, pp182-188

Havelock, R., & Huberman, M. (1977)
'Solving educational problems'
in S. Rodwell (1986) *Managing educational change - key issues in educational innovation, section 2.1*
University of London Institute of Education

Havelock, R.G. (1969)
Planning for innovation through dissemination and utilization of knowledge
Institute for Social Research Publications, University of Michigan, Ann Arbor, Michigan

Havelock, R.G. (1970)
A guide to innovation in education
Center for Research on Utilization of Scientific Knowledge, Institute for Social Research, The University of Michigan, Ann Arbor, Michigan

Havelock, R.G. (1971)
Innovations in education, strategies and tactics
Working paper, Center for Research on Utilization of Scientific Knowledge, University of Michigan, Ann Arbor

Hendry, C. & Pettigrew, A. (1986)
'The practice of strategic human resource management'
in *Personnel Review*, 15(5), pp3-8

Hickson,D.J., Butler,R.J., Cray,D., Mallory,G.R., & Wilson,D.C.
(1986)
Top Decisions
Oxford: Basil Blackwell

Hirschheim,R.A. (1985)
Office automation: concepts, technologies and issues
Addison-Wesley, Harcourt Brace Jovanovich, Inc

HMI (1977)
Ten Good Schools
Her Majesty's Inspectorate, DES London: HMSO

Holly,P.J. (1984)
'The institutionalisation of action-research in schools'
in *Cambridge Journal of Education*, 14, 2, Easter Term

Hopkins,D. (1986)
'The change process and leadership in schools'
in *School Organisation*, 6, ppl

Howell,D.A. & Brown,R. (1983)
Educational Policy Making: an analysis
Heinemann Educational Books for the Institute of Education,
University of London

Hoyle,E. (1973)
'Strategies for curriculum change'
in R.Watkins (ed.) *In-service training: structure and content*
Ward Lock

Haugo,J. (1981)
'Management applications of the microcomputer: promises and pitfall'
in *AEDS Journal*, V14, n4, pp182-188

Hurst,P. (1983)
Implementing educational change - a critical review of literature
Occasional Paper No.5, Department of Education in Developing
Countries, University of London Institute of Education

Hurst,P. (1986)
The use of microcomputer in educational administration
University of London Institute of Education

Jordan,N. (1968)
'Some thinking about "system"'
in F.E.Emery (ed.) *Systems thinking: Volume two*, pp15-39
Penguin Books Ltd.

Joyce,B., & Weil,M. (1986)
Models of Teaching
Prentice-Hall International, 3rd edition

Kanter,R.M. (1983)
The change masters: corporate entrepreneurs at work
London: Counterpoint, Unwin Paperbacks

Kast,F.E.& Rosenzweig,J.E. (1970)
'The modern view: a systems approach'
in Open Systems Group (ed.) *Systems behaviour*, pp44
Harper & Row, 3rd edition, 1985

Kleiner,B.H. & Corrigan,W.A. (1989)
'Understanding organisational change'
in *Leadership & Organization Development Journal*, Volume 10, Number
3, pp25-31

Kuhlmann,T.M. (1988)
'Adapting to technical change in the workplace'
in *Personnel*, August, pp67-69

Lam, C.C. (1991)
The implementation of curriculum change in moral education in secondary schools in Hong Kong
PhD Thesis, University of London Institute of Education

LAMSAC. (1974)
Towards a computer based education management information system
Local Authority Management Services and Computer Committee, U.K.

LAMSAC. (1978)
Computer assisted school timetabling
Local Authority Management Services and Computer Committee, U.K.

Lancaster,D. (1989)
'Management information systems: aspects of management information systems'
in B.Fidler & G.Bowles (eds.) *Effective local management of schools*
U.K.: Longman

Lawler,E.E. & Bachrach, S.B. (1986)
Power and politics in organizations
New York: Jossey-Bass

Leathem,J.T. (1989)
'Managing organizational change'
in *Business Quarterly*, Summer, pp39-43

Leavitt,H.J., & Pondy,L.R. (eds.) (1964)
Readings in managerial psychology
The University of Chicago Press, Chicago & London

Leavitt,H.J., Dill,W.R., & Eyring,H.R. (1973)
The organizational world
Harcourt Brace Jovanovich, Inc., New York

Lee,R. & Lawrence,P. (1985)
Organizational behavior: politics at work
London: Hutchinson

Levin,H.M. (1974)
'Educational reform and social change'
in *Journal of Applied behavioral Science*, 10, no.3

Lewin,K. (1957)
'Frontiers in group dynamics: concept, method, and reality in social science'
in *Human Relations*, I, 1957, pp5-42. Also in H.Leavitt & L.Pondy (eds.)
Readings in managerial psychology, pp335,
The University of Chicago Press, Chicago & London

Lewis,D.G. (1968)
'Centralized computer systems'
in *Technology and innovation in education: putting educational technology to work in America's schools*
Aerospace Foundation

Lippitt,R., Watson,J., & Westley,B. (1958)
The dynamics of planned change
Harcourt, Brace and World, Inc., New York, 131-143

Lockett,M., & Spear,R. (eds.) (1980)
Organizations as systems
The Open University Press, Milton Keynes

Lodahl,T. (1980)
'Cost-benefit concepts and applications for office automation'
in *Proceedings of the 1980 Office Automation Conference*, Atlanta

Lorsch,J. (1986)
'Managing culture: the invisible barrier to strategic change'
in *California Management Review*, Winter, pp95-109

Marklund,S. (1972)
The new role of the teacher in Swedish innovative schools
OECD, Paris

McDonough,A.M., & Garrett,L.J. (1967)
Management systems: working concepts and practices
Richard Irwin Inc

McEwen,N., Carmichael,C., Short,D., & Steel,A. (1988)
'Managing Organizational change - a strategic approach'
in *Long Range Planning*, Vol.21, No.6, pp71-78

McLaughlin,M.W. (1976)
'Implementation as mutual adaptation: change in classroom organization'
in *Teachers College Record*, Vol 77, no. 3 (1976), pp339-351

Meares,L. (1986)
'A model for changing organizational culture'
in *Personnel*, July, pp38-42

Miles,M.B. (ed.) (1964)
Innovation in education
Teachers College, Columbia University

Morris,P. (1986)
'Teachers' perceptions of the barriers to the implementation of a
pedagogic innovation: a South East Asian case study'
in *International Review of Education*, 31 (1)
Paris: UNESCO

Morris,P. (1987)
'Curriculum innovation and implementation: a cautionary note'
in *Educational Research Journal 1987*, Vol. 2, pp49-54
Hong Kong

Myer,E. (1964)
'Communication difficulties in total system design'
in D.D.Bushnell (ed.) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education
Association of the United States.

Neihoff,A.H. (1966)
'The process of innovation'
in A.H.Neihoff (ed.) *A casebook of social change*
Aldine Publishing Company, Chicago

Nicholls,A. (1983)
Managing educational innovations
George Allen & Unwin

Nisbet,J. (1974)
'Strengthening the creativity of the school'
in *Creativity of the school*
CERI, Paris: OECD

NYSSCSS. (1984)
*The New York State school computer services system: overview of
present situation*
The University of the State of New York, the State Education
Department, Office of ESC Planning and Support Services

Open Systems Group (ed.) (1981)
Systems behaviour
Harper & Row Publishers, 3rd edition

Owens, R.G. (1982)
'Methodological rigor in naturalistic inquiry: some issues and answers'
in *Educational Administration Quarterly*, Vol. 18, No. 2 (Spring 1982), pp1-21

Parkin, A. (1980)
Systems analysis
Arnold

Parlett, M. & Hamilton, D. (1977)
'Evaluation as illumination: a new approach to the study of innovatory programmes'
in D. Hamilton et al. (eds.) *Beyond the numbers game*, pp6-22
Macmillan Education

Peters, T. & Austin, N. (1985)
A passion for excellence
Fontana Paperbacks

Peters, T. & Waterman, R.H. (1982)
In search of excellence
New York, Harper and Row

Pettigrew, A. (1985)
The awakening giant: continuity and change in ICI
Oxford: Basil Blackwell

Pettigrew, A. (1973)
The politics of organizational decision-making
London: Tavistock

Pfeffer, J. (1981)
Power in organizations
New York: Pitman

Price,S. (1979)
Introducing the electronic office
NCC Publications

Purkey,S.C. & Smith,M.S. (1985)
'School reform: the district policy implications of the effective schools literature'
in *The Elementary School Journal, University of Chicago*, 85, pp3

Ransome,N. (1984)
'SAM'S progress'
in *Times Educational Supplement*, 2nd March 1984, pp44-45

Reid,K., Hopkins,D., & Holly,P. (1987)
Towards the effective school
Basil Blackwell: Oxford

Richland,M. (1965)
'Designing education for the future eight-state project'
Seminar and Conference for the implementation of educational innovation, Denver, Colorado, October 1966, pp32
System Development Corporation, Santa Monica, California

Rodwell,S. (1986)
Managing educational change - units 1-4: key issues in educational innovation
University of London Institute of Education

Rogers,E., & Rogers,R.A. (1976)
Communication in organizations
Collier Macmillan, London

Rogers,E., & Shoemaker,F. (1971)
Communication of innovations: a cross-cultural approach
New York: Free Press

SSRC. (1983)
Microcomputers in education
Social Science Research Council, School Government Publishing Company, U.K.

Sarason, S. (1971)
The culture of the school and the problem of change
Boston: Allyn & Bacon, 2nd edition, 1982

Schmuck, R.A. (1974)
'Interventions for strengthening the school's creativity'
in CERI *The creativity of the school*
OECD, Paris

Schmuck, R.A. & P.A. (1974)
A humanistic psychology of education making the school everybody's house
Mayfield: National Press Books

Schmuck, R., Runkel, P., Arends, J., & Arends, R. (1977)
The second handbook of organizational development in schools
Palo Alto: Mayfield

Schoderbek, P.P. (1968)
Management systems: a book of readings
John Wiley & Sons Inc

Schon, D. (1971)
Beyond the stable state
New York: Norton

Schure, A. (1968)
'Off-line use of computers'
in *Technology and innovation in education: putting educational technology to work in America's schools*
Aerospace Foundation

Semrau, P. (1990)
'A case study of two school systems' use of computers in educational administration: Burbank and Arcadia'
in *School Organisation*, Vol. 10, No.1, 1990, pp119-137

Shaw, A. & Lancaster, D. (1986)
A study of the use of microcomputer in secondary school administration
Sheffield City Polytechnic, Department of Education Management, U.K.

Silverman,D. (1970)
The theory of organisations
Heinemann Educational Books

Simon,H.A. (1959)
Administrative behavior
New York: Macmillan

Simons,H. (1971)
'Case-studies of Innovation'
in D.Hamilton et al. (eds.) *Beyond the numbers game*, pp178-180
Macmillan Education

Spuck,D.W., & Atkinson,G. (1983)
'Administrative uses of the microcomputer'
in *AEDS Journal*, V17, n1-2, Fall, 1983, pp83-90

Stenhouse,L. (1978)
'Case study and case records: towards a contemporary history of education'
in *British Educational Research Journal*, Vol. 4, No. 2, pp21-39

Stenhouse,L. (1979)
'Case study in comparative education: particularity and generalisation'
in *Comparative Education*, Volume 15 No. 1 March 1979, pp5-10

Stiles,L.J., & Robinson,B. (1973)
'Change in education'
in G.Zaltman et al. (eds.) *Processes and phenomena of social change*
New York: Wiley Interscience

Stone,J.L. (1968)
'The information sciences requirement'
in *Technology and innovation in education: putting educational technology to work in America's schools*
Aerospace Foundation

Strassman,P. (1980)
'The office of the future: information management for the new age'
in *Technology Review*, December/ January,1980

Tessler,D. (1989)
'The human side of change'
in *Director*, October, 1989, pp88-93

Theodossin,E. (1983)
'Theoretical perspectives on the management of planned educational change'
in *British Educational Research Journal*, N9(1), pp81-90

Thomas,G. (1989)
'MIS at St. Peter's secondary school'
in B.Fidler & G.Bowlen (eds.) *Effective local management of schools*
Longman

Toffler,A. (1985)
The adaptive corporation
London: Pan Books Ltd

Tunstall,W. (1986)
'The breakup of Bell System: a case study in cultural transformation'
in *California Management Review*, Winter, pp110-24

Turrill,T. (1986)
Change and innovation
The Institute of Health Services Management, U.K.

Uhlig,R., Farber,D., & Bair,J. (1979)
The office of the future
North-Holland

Visscher,A.J. (1991)
'Computer assisted school administration - the Dutch experience'
in *Computer assisted school administration & management: An international analysis, Journal of Research on Computing in Education*, Volume 24, Fall 1991

Visscher,A.J. (1991)
'Computer assisted school administration & management: A framework for analysis'
in *Journal of Research on Computing in Education*, Volume 24, Fall 1991

Wagner,E. (1964)
'Data processing and school administrative services'
in D.D.Bushnell (ed.) *The automation of school information systems*
Department of Audiovisual Instruction of the National Education
Association of the United States

Walton,R.E. (1985)
'From control to commitment: transforming work-force management in
the USA'
in Clark,K., Hayes,R., & Lorenz,C. (eds.) *The uneasy alliance:
managing the productivity-technology dilemma*
Boston, Ma.: Harvard Business School Press

Warren,R.L. (1977)
Social change and human purpose: toward understanding and action
Rand McNally College Publishing Company, U.S.A

Watts,P. (1985)
*Computer aided administration (CAA): the final report of the pilot
project in ILEA Secondary Schools*
Inner London Education Computing Centre (ILECC), U.K.

Weick,K.E. (1969)
The social psychology of organizing
New York: Addison-Wesley

Whisler,T. (1970)
The impact of computers on organizations
Praeger Publishers, New York

Wilson,S. (1977)
'The use of ethnographic techniques in educational research'
in *Review of Educational Research*, Winter 1977, Vol. 47, No.2,
pp245-265

Zaltman,G., Duncan,R., & Holbek,J. (1973)
Innovation and organizations
Wiley

